

September 17, 2003

Ms. Estena McGhee
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Dear Ms. McGhee:

Subject: Revised RFI Workplan
Wheeling-Pittsburgh Steel Corporation
Follansbee, West Virginia
CEC Project 210052(3000)

On behalf of Wheeling-Pittsburgh Steel Corporation (WPSC) and in response to your letter to WPSC dated August 14, 2003, enclosed please find four (4) copies of the revised RFI Workplan for the WPSC facility located in Follansbee, West Virginia. The workplan has been revised to incorporate changes based on written and verbal correspondence between WPSC and U. S. Environmental Protection Agency (U.S. EPA) since the original workplan was submitted on November 4, 1999.

Should you have any questions, please call me at (724) 327-5200 or Bud Smith at (304) 234-2662.

Very truly yours,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.


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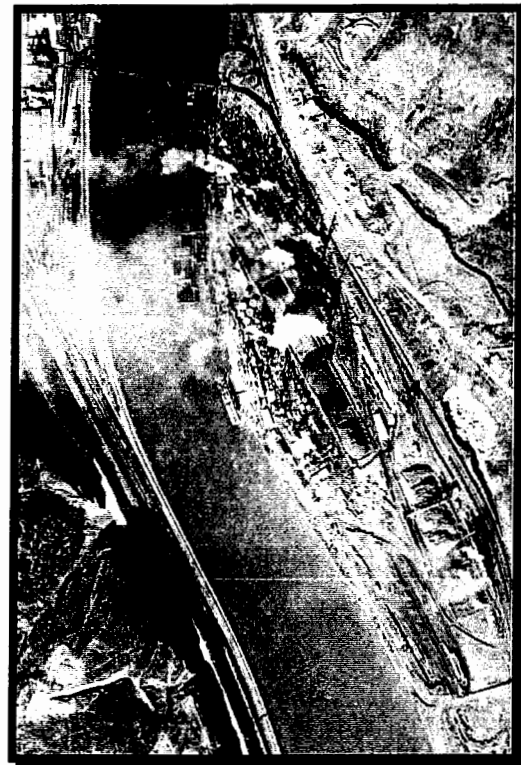
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RCRA Facility Investigation Workplan

RCRA Corrective Action
Steubenville East Coke Plant
Follansbee, West Virginia

1966



1954



05 November 1999
Revised 17 September 2003

P R E P A R E D F O R

Wheeling  **Pittsburgh**
STEEL CORPORATION

RCRA Facility Investigation Workplan

**RCRA Corrective Action
Steubenville East Coke Plant
Follansbee, West Virginia**

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Date:
05 November 1999
Revised 17 September 2003

PREFACE

This RCRA Facility Investigation Workplan was organized based on the outline presented in the Final Administrative Order (Appendix B) and is divided into the following two Parts:

PART 1

- Section 1 - Project Management Plan
- Section 2 - Data Collection Quality Assurance Plan
- Section 3 - Data Management Plan
- Section 4 - Community Relations Plan

PART 2

- Health and Safety Plan

The **PROJECT MANAGEMENT PLAN** describes the technical approach, project management approach, personnel and schedule. The project management plan also includes a description of contractor personnel.

The **DATA COLLECTION QUALITY ASSURANCE PLAN** describes the data collection strategy and presents a plan to document all monitoring procedures: sampling, field measurement, and sample analysis performed during the investigation to characterize the environmental setting, source and contamination. This plan is designed to ensure that all information, data and resulting decisions are technically sound, statistically valid as necessary, and properly documented.

The **DATA MANAGEMENT PLAN** describes how the data will be recorded, evaluated and presented in the RFI report

The **COMMUNITY RELATIONS PLAN** presents a plan for dissemination of information to the public regarding investigation activities and results.

The **HEALTH AND SAFETY PLAN** describes the known chemical and physical hazards associated with the proposed RFI activities and outlines the procedures for protecting personnel from these hazards.

LIST OF ACRONYMS/ABBREVIATIONS

ACGIH	American Conference of Governmental and Industrial Hygienists	DQO	Data Quality Objectives
ADD	Average daily dose	DTTS	Decanter Tank Tar Sludge
ADI	Allowable Daily Intake	DTTSI	Decanter Tank Tar Sludge Impoundment
AST	Above Ground Storage Tank	ECAO	Environmental Criteria and Assessment Office
Allied	Allied Oil Company	EDD	Electronic Data Deliverables
AQA/LCP	Analytical Quality Assurance/Laboratory Contract Program	EMSL	EPA Environmental Monitoring Systems Laboratory
ARARs	Applicable or Relevant and Appropriate Requirements	ER-L	Effects Range Low
ARCADIS	ARCADIS Geraghty & Miller	ER-M	Effects Range Median
ASTM	American Society of Testing Materials	ERNS	Emergency Response Notification System
AWQC	Ambient Water Quality Criteria	FEL	Field Equipment Logbook
BOD	Biological Oxygen Demand	FOL	Field Operation Leader
BOF	Boiler Oven Furnace	FID	Flame Ionization Detector
BTEX	Benzene, Toluene, Ethyl Benzene, Xylene	FINDS	Facility Index System
CDC	Center for Disease Control	ft.	Foot
CEC	Civil & Environmental Consultants, Inc.	ftbgs	Foot/Feet Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	GC	Gas Chromatography
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System	GC/MS	Gas Chromatograph/Mass Spectrometer
CLP	Contract Laboratory Program	GFAA	Graphite Furnace Atomic Adsorption
cm	Centimeter	gpd	Gallons Per Day
CSF	Cancer slope factor	HASP	Health and Safety Plan
COD	Chemical Oxygen Demand	HHRA	Human Health Risk Assessment
COG	Coke Oven Gas	HQ	Hazard Quotient
COPC	Chemical of Potential Concern	HSA	Hollow-Stem Auger
COPEC	Constituent of Potential Ecological Concern	ICP	Inductively Coupled Argon Plasma
CRP	Community Relations Plan	IDLH	Immediate Danger to Life and Health
CRZ	Contamination Reduction Zone	IM	Interim Measures
CSM	Conceptual Site Model	KII	Koppers Industries Incorporated
DCQAP	Data Collection Quality Assurance Plan	LADD	Lifetime Average Daily Dose
DMP	Data Management Plan	LCS	Laboratory Control Sample
DNAPL	Dense Non-Aqueous Phase Liquid	LEL	Lower Explosive Level
DOCC	Description of Current Conditions	LNAPL	Light Non-Aqueous Phase Liquid
		MCL	Maximum Contaminant Level
		MDL	Method Detection Limit
		MHz	Megahertz
		mgd	Million Gallons Per Day

mg/L	Milligram Per Liter	SOPs	Standard Operating Procedures
mg/kg	Milligrams Per Kilogram	SOW	Statement of Work
mph	Miles Per Hour	SQC	Sediment Quality Criteria
MS	Matrix Spike	SSO	Site Safety Officer
MSA	Method of Standard Additions	SQL	Sample Quantitation Limit
MSD	Matrix Spike Duplicate	SVOC	Semivolatile Organic Compound
MSDS	Material Safety Data Sheets	SWMUs	Solid Waste Management Units
NFG	National Functional Guidelines	SWP	Safe Work Practices
NOAA	National Oceanic and Atmospheric Administration	TBC	To-Be-Considered
NOAEL	No-Observable-Adverse-Effect Level	TCL	Target Compound List
NPL	National Priorities List	TDS	Total Dissolved Solids
OMEE	Ontario Ministry of Environment and Energy	TLV	Threshold Limit Value
ORDER	Administrative Order	TPH	Total Petroleum Hydrocarbons
ORNL	Oak Ridge National Laboratory	TSS	Total Suspended Solids
OSWER	Office of Solid Waste and Emergency Response	TOC	Total Organic Carbon
PARCC	Precise, Accurate, Representative, Comparable and Complete	UCL	Upper Confidence Limit
PAH	Polynuclear Aromatic Hydrocarbons	ug/L	Microgram Per Liter
PCBs	Polychlorinated Byphenols	ug/kg	Microgram Per Kilogram
PID	Photoionization Detector	USCS	Unified Soil Classification System
PDA	Plant Debris Area	USEPA	U.S. Environmental Protection Agency, Region III
PEL	Permissible Exposure Level	USGS	United States Geological Survey
ppb	Parts Per Billion	UST	Underground Storage Tank
PPE	Personal Protective Equipment	WPSC	Wheeling-Pittsburgh Steel Corporation
ppm	Parts Per Million	WVDEP	West Virginia Division of Environmental Protection
PQL	Practical Quantitation Limit	WVDNR	West Virginia of Natural Resources
QA/QC	Quality Assurance/Quality Control	VOCs	Volatile Organic Compounds
RBCs	Risk-based concentration		
RCRA	Resource Conservation and Recovery Act		
Rfd	Reference dose		
RFI	RCRA Facility Investigation		
RME	Reasonable Maximum Exposure		
RPDs	Relative Percent Difference		
RPM	USEPA Remedial Project Manager		
RRF	Relative Response Factor		
RSD	Relative Standard Deviation		
SCBA	Self-Contained Breathing Apparatus		
sec	Second		

PART 1

PROJECT MANAGEMENT PLAN
DATA COLLECTION QUALITY ASSURANCE PLAN
DATA MANAGEMENT PLAN
COMMUNITY RELATIONS PLAN

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RFI Workplan

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1. PROJECT MANAGEMENT PLAN

1.1 Introduction

1.1.1 Purpose

On June 29, 1998, Wheeling-Pittsburgh Steel Corporation (WPSC) received a Final Administrative Order (Order) under Section 3008(h) of the Resource Conservation and Recovery Act, as amended, 42 U.S.C. Section 6928(h) from the United States Environmental Protection Agency (U.S. EPA) Region III (U.S. EPA Docket No. RCRA-III-080-CA) for the Steubenville East Coke Plant. The Order encompasses the entire facility with the exception of the former DTTSI, which is being investigated under a separate Administrative Consent Decree issued October 2, 1989. While some information regarding the former DTTSI is presented in this report to supplement our understanding of the facility as a whole, the former DTTSI is not included in the 3008(h) Order.

Section VI.B.9. of the Order specifies submittal of a RCRA Facility Investigation Workplan (RFI Workplan) for the facility. The purpose of the RFI Workplan is to present a plan to generate data which will be used in order to make decisions regarding corrective action at the facility.

1.1.2 Objectives

The major objectives of the RFI Workplan are to:

- Characterize the potential pathways of contaminant migration;
- Characterize the source areas;
- Define the degree and extent of contamination;
- Identify actual or potential human and/or ecological receptors; and,
- Determine the impact of contamination on human health and/or ecological receptors

1.1.3 Preparation and Organization of the RFI Workplan

Historical aerial photos, maps, water quality and water-level data, well construction and installation data, previous investigation reports and the DOCC (dated August

1998) were reviewed in the development of this RFI Workplan. The RFI presented in this document is organized based on the outline presented in the Final Administrative Order and is divided into the following two parts:

PART 1

- Project Management Plan
- Data Collection Quality Assurance Plan
- Data Management Plan
- Community Relations Plan

PART 2

- Health and Safety Plan

The **PROJECT MANAGEMENT PLAN** describes the technical approach, project management approach, personnel and schedule. The project management plan also includes a description of contractor personnel.

The **DATA COLLECTION QUALITY ASSURANCE PLAN** describes the data collection strategy and presents a plan to document all monitoring procedures: sampling, field measurement, and sample analysis performed during the investigation to characterize the environmental setting, source and contamination. This plan is designed to ensure that all information, data and resulting decisions are technically sound, statistically valid as necessary, and properly documented.

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The **COMMUNITY RELATIONS PLAN** presents a plan for dissemination of information to the public regarding investigation activities and results.

The **HEALTH AND SAFETY PLAN** describes the known chemical and physical hazards associated with the proposed RFI activities and outlines the procedures for protecting personnel from these hazards.

1.2 Facility Background

1.2.1 Introduction

The Steubenville East Coke Plant is located immediately north of Follansbee, Brooke County, West Virginia on West Virginia State Route 2 (Figure 1). The coordinates of the facility are 80° 36' east longitude and 40° 20' north latitude. Coking operations and coke byproduct production have been performed at the facility since approximately 1917. Past and current operations performed at the facility include the production of metallurgical-grade coke for use in steel production, the processing of coke-oven gas in the Byproducts Plant, and the recovery of iron units from miscellaneous plant byproducts and ore in the Sinter Plant.

1.2.2 Topography, Property Boundaries and Surrounding Areas

The ground surface of the main plant area (west of West Virginia State Route 2) is relatively level with surface elevations ranging from approximately 440 feet to 460 feet relative to plant datum (672 to 692 relative to mean sea level). A portion of the facility, which currently consists of the employee parking areas and a Closed Sludge Drying Bed, is located east of West Virginia State Route 2 and is relatively level. Surface relief increases steeply to the east of the parking/Closed Sludge Drying Bed area to approximately 1000 feet above mean sea level along the valley wall (Figures 1 and 2).

The property boundaries for the Steubenville East Coke Plant are shown on Figure 2. The facility currently occupies approximately 588 acres along the eastern bank of the Ohio River (183 acres between the river and West Virginia State Route 2 and 405 acres east of West Virginia State Route 2). Prior to approximately the year 1900, numerous individuals owned the property that is now the Steubenville East Coke Plant. From approximately 1907 to 1917 the properties were sold to La Belle Iron Works, which eventually became Follansbee Steel Corporation, then Wheeling Steel Corporation, then Wheeling-Pittsburgh Steel Corporation.

In the past, various parcels of land were leased to different entities, notably the northern end of the facility to Allied Oil Company (Allied) for a fuel storage operation. In addition, Mr. Paul Hatcher leased from WPSC an area south of the current Plant Debris Area for an Ash Screening Plant. Currently, Provenzano Trucking, PGP Trucking, and Murphy Consolidated Industries lease land from WPSC (Figure 2).

The city of Follansbee and Wheeling-Nisshin Steel Corporation border the facility to the south and southeast (Figure 2). Koppers Industries, Inc. (KII) and the Ohio River delineate the western boundary of the facility. Residences and commercial establishments occupy properties east and southeast of the facility along West Virginia State Route 2. WPSC owns the large wooded area to the east of the employee parking/Closed Sludge Drying Bed area, which essentially covers the entire hillside overlooking the valley. Undeveloped property lies to the north of the facility and commercial property to the northeast.

1.2.3 Regional Hydrogeology

The hydrogeologic information provided in this section was obtained from the West Virginia Geological Survey and from previous investigations performed by ARCADIS. The sources for this information are provided in Section 6 entitled References, of the Description of Current Conditions (DOCC) dated August 1998.

The Steubenville East facility is located along the eastern bank of the Ohio River on the northern portion of an alluvial terrace named the Follansbee Bottom (Carlston and Graeff, 1955). The predominant topographical characteristic of the bottom is a series of river terraces eroded in the sides of a high, fluvio-glacial, fill terrace (Carlston and Graeff, 1955). Tributary streams cut through the fill as they flow toward the Ohio River. The facility lies entirely above the 100 year floodplain of the Ohio River.

Follansbee Bottom is situated in the Appalachian Plateau physiographic province (Cross and Schemel, 1956). Between the Ohio River and West Virginia State Route 2, the facility is constructed on metallurgical slag and miscellaneous fill materials deposited on the naturally-occurring Quaternary-age alluvial deposits. To the east of West Virginia State Route 2, limited boring information indicates some fill areas underlain by colluvial deposits.

Bedrock consisting of the Pennsylvanian-age Conemaugh Series is encountered at depths varying from approximately 44 feet to 86 feet below the ground surface at the facility. The Conemaugh Series is comprised of cyclical sequences of shale, siltstone, sandstone, coal and limestone. In the vicinity of the facility, bedrock is typically shale, siltstone, claystone, and/or sandstone.

No bedrock outcrops, carbonate rocks, or sinkholes are evident at the facility. Bedrock outcrops may occur in the hillsides to the north and east of the facility. In general, bedrock underlying the Ohio River Valley of West Virginia dips in a south-southeast direction at a rate of approximately 15 to 30 feet per mile (Carlston and Graeff, 1955).

In the vicinity of the site, the axis of the Mingo Syncline trends to the north through the site before shifting to the northeast north of Fairy Glen (adjacent to Archer Heights) (Cross and Schemel, 1956). In relation to the local structure, most of the main plant area lies either within the fold axis of the syncline or on the northwestern limb of the syncline. There is no available information regarding bedding plane orientation, joints, faults, or other types of fracture zones within the facility area. A surficial geologic/structure map is presented as Figure 3 in the DOCC.

Both surface and subsurface coal mining activities have been extensive in the vicinity of the site. Strip mines are located in the hills on both sides of the Ohio River. Reclaimed surface mines are also evident in the general vicinity of the site (Figure 1). The Lower and Middle Kittanning Coals, the Lower Freeport Coal, and an unknown coal seam underlie the site (West Virginia Geologic and Economic Survey Preliminary Open-File Reports).

Based on available information, the La Belle Mine is located beneath most of the facility. The coal seam believed to be mined at the La Belle Mine is the Lower Freeport Coal (Repine, 1986). The approximate depth to the base of the Lower Freeport Coal beneath the BOF Residuals Storage Area, for example, is 230 feet (West Virginia Geologic and Economic Survey Preliminary Open-File Report).

1.2.4 Facility Geology

The hydrogeologic information provided in this section was obtained during previous investigations at the Steubenville East facility and from documents summarizing investigations performed at the KII facility. The sources for these data are provided in Section 1.11, entitled References. In general, the nature of the geologic deposits grades from alluvial beneath the main plant area, to alluvial/colluvial beneath the Plant Debris/BOF Residuals Storage Areas, to colluvial beneath the Closed Sludge Drying Bed. For ease of discussion, the facility has been divided into these three areas based on geology: Main Plant Area, Plant Debris/BOF Residuals Storage Areas, and the Closed Sludge Drying Bed Area. Lines of geologic cross-section are shown in Figure 4 of the DOCC and the geologic cross-sections are presented as Figures 5 through 11 of the DOCC.

1.2.4.1 Main Plant Area

For purposes of this discussion, the main plant area is comprised of the facility west of West Virginia State Route 2, not including the Plant Debris/BOF Residuals Storage Areas. Unconsolidated deposits beneath the main plant area consist of up to 28 feet of

surficial metallurgical slag and miscellaneous soil fill, overlying a 22 to 34 feet thick, fine-textured sandy to silty clay unit. Beneath the sandy and silty clay are glacial deposits comprised of interbedded, poorly sorted medium to coarse sand and gravel that coarsen with depth. The glacial deposits range up to 42 feet in total thickness (Geraghty & Miller, Inc., 1995a). At some locations, silty fine sand replaces the lower portion of the sandy and silty clay unit. Subsurface conditions beneath the main plant area are detailed in cross section as Figures 5 through 8 in the DOCC.

Surficial fill beneath the main plant area is comprised of sand to cobble-sized metallurgical slag mixed with brick, cinder and soil. The surficial fill ranges in thickness from about six feet beneath the former DTTSI to 28 feet in thickness beneath the north coke stockpile area. The underlying sandy and silty clay alluvium ranges in composition across the site, from a fine sandy clay or sandy silt to silt and clay. The alluvium ranges from three feet in thickness beneath the former DTTSI to 32 feet in thickness beneath the southern portion of the facility (well MW-2A).

Extending from the base of the silty and sandy clay to the top of bedrock are deposits of stratified sands and gravel that were deposited within the Ohio River Valley during the retreat of the Pleistocene-age glaciers. The glacial deposits are comprised of a poorly sorted, medium to coarse sand and gravel. At several locations (i.e., beneath the former DTTSI and at wells MW-1 and VA-1), the sand and gravel is overlain by a sand with varying fractions of silt. The glacial deposits range in total thickness from about 22 feet at well MW-2A to 42 feet at well R-310. The glacial deposits thin and gradually pinch out against the valley wall, to the east.

Beneath the main plant area, bedrock was encountered at depths ranging between 57 feet (well VA-1A) and 85 feet (well R-310) below ground surface (bgs). Based upon bedrock cores obtained from well R-310, bedrock consists predominantly of relatively soft claystone with varying fractions of silt, and to a lesser extent, fine-grained silty sandstone. Thin lenses of shale, limestone and coal exist within the claystone and sandstone (ICF Kaiser, 1994).

1.2.4.2 Plant Debris/BOF Residuals Storage Area

The geology in the vicinity of the Plant Debris Area and the BOF Residuals Storage Area is characterized by a change in the unconsolidated sediments from south to north (from wells PDA-2 to RSA-3) and from east to west (Figures 9 and 10 of the DOCC). Wells PDA-2, PDA-3, PDA-4, RSA-2 and RSA-3 are located downgradient of the Plant Debris Area and the BOF Residuals Storage Area in the general location of a former gravel operation where earth moving activities occurred.

On the downgradient side of the debris areas, approximately 10 to 20 feet of fill is underlain by a thick (approximately 15 feet) clay unit (at wells PDA-2 through PDA-4) and silt, sand and/or clay with gravel and rock fragments at wells RSA-2 and RSA-3. At wells PDA-2 through PDA-4, a thin (on the order of a few feet) perched water zone was encountered above the clay unit. A perched water zone was not encountered during the installation of wells RSA-2 and RSA-3. In general, the borings for these wells next encountered sand and gravel mixed with silt, rock fragments, and silt. The thickness of the unconsolidated deposits encountered during drilling downgradient of the debris areas ranged from 37 feet (RSA-2) to 62 feet (PDA-3); however, the total thickness is somewhat greater since none of the boreholes encountered bedrock.

Wells PDA-1 and RSA-1 are located upgradient of the Plant Debris Area and BOF Residuals Storage Area, closer to the valley wall. Fill materials were absent at these locations. In general, the sediments encountered were 10 to 11 feet of clay with rock and coal fragments, followed by 37 to 41 feet of sand and rock fragments, with varying amounts of clay, silt, gravel, and coal. These unconsolidated sediments are interpreted to be alluvial/colluvial deposits. Well PDA-1 encountered sandstone bedrock at 47.6 bgs and well RSA-1 encountered weathered shale above siltstone or claystone at approximately 48 feet bgs.

1.2.4.3 Closed Sludge Drying Bed Area

The Closed Sludge Drying Bed area is located across from the main plant area to the east of West Virginia State Route 2. Figure 11 of the DOCC shows a geologic cross-section through this area. Samples from the borings indicate that this area is mainly underlain by fill and colluvial deposits. The fill deposits range in thickness from 15 to 50 feet thick and are composed of silt, clay, sand, and/or gravel with varying proportions of cinders, ash, slag, brick fragments, rock fragments and coal. Underlying the fill, unconsolidated materials (silt, sand, gravel, clay, rock and coal fragments) range in thickness from approximately four feet to 31 feet. Bedrock underlying the unconsolidated materials was encountered between 40 to 60 feet bgs and was composed of weathered shale, claystone and siltstone.

1.2.5 Facility Hydrogeology

Groundwater exists in unconsolidated deposits beneath the facility as perched water within the lower portion of the fill and silty sand (perched zones) and in the saturated glacial deposits (the Ohio River Valley alluvial aquifer). The water-level elevation database for the facility wells is presented in Appendix A. Facility wells are shown on Figure 2.

1.2.5.1 Perched Water Zones

Perched water zones occur where infiltrating water accumulates within relatively permeable fill or silty sand deposits above finer-textured, clayey alluvium. The fine-textured alluvium, with a reported permeability of 3.1×10^{-6} to 5.8×10^{-8} centimeters per second (cm/sec), restricts the downward infiltration of groundwater creating perched zones (ICF Kaiser, 1994).

Perched groundwater was encountered at depths ranging from 3.5 feet (piezometer V3, located within the former DTTSI to about 16.5 feet (GM-3T) bgs. Perched groundwater was not encountered in the vicinity of wells VA-1, VA-1A, P-1, P-2, MW-2A, RSA-series wells, PDA-1 and the SDB-series wells. Fluid-level elevations developed from facility water-level data indicate that the surface of the perched groundwater ranges from about 12 feet (TDI-2P and TDI-1P) to 17 feet (VP-2) higher than the potentiometric surface of the subjacent alluvial aquifer (Table 2 in the DOCC, Geraghty & Miller, Inc., 1996b). In general, the perched water zones are discontinuous and tend to be relatively thin and cannot sustain continuous pumping, even at low pumping rates.

1.2.5.2 Alluvial Aquifer

Geologic deposits underlying the facility grade from alluvial to colluvial as the valley wall is encountered. The alluvial and colluvial deposits are hydraulically connected; therefore, for purposes of this discussion, these saturated zones will be called the alluvial aquifer. Unconsolidated deposits comprising the alluvial aquifer include the silty sand unit at the former DTTSI and wells MW-1 and VA-1, the underlying sand and gravel outwash deposits beneath the main plant area and Plant Debris/BOF Residuals Storage Areas and the more colluvial deposits encountered at wells PDA-1, RSA-1 and the SDB-series wells. Groundwater elevations determined for the Steubenville East facility indicate that the alluvial aquifer exists under confined conditions beneath most of the facility, with the potentiometric surface of the alluvial aquifer extending above the top of the sand and gravel unit. West of West Virginia State Route 2, depths to groundwater range from 7.9 feet to 45 feet below the ground surface (wells MW-1 and RSA-1, respectively). In the vicinity of the Plant Debris Area and BOF Residuals Storage Area, the alluvial aquifer exists under confined conditions where thick clay overlies the aquifer (PDA-2, PDA-3, and PDA-4) and under unconfined conditions where the confining clay is thin or absent (RSA-2 and RSA-3).

In the vicinity of the Closed Sludge Drying Bed, the uppermost water-bearing zone (if present) is present in colluvial deposits located above the bedrock. Groundwater is not present in unconsolidated deposits at wells SDB-3 and SDB-5, which are located on a bedrock high. In the remainder of the SDB-series wells, the uppermost water-bearing zone ranges in thickness from approximately one foot at well SDB-2 to eight feet at wells SDB-1 and SDB-4.

An interpretation of groundwater flow patterns within the alluvial aquifer was developed from groundwater elevation data collected on September 9, 1997. The generalized groundwater flow patterns (shown on Figure 12 of the DOCC) indicate that groundwater within the alluvial aquifer flows towards, and discharges to, the Ohio River. Because the alluvial aquifer is in hydraulic communication with the Ohio River, groundwater levels fluctuate in response to river stage. Consequently, reversals in hydraulic gradients between the Ohio River and the alluvial aquifer may occur during high river flow conditions. The alluvial aquifer is prolific, with reported hydraulic conductivities and transmissivities of approximately 8×10^{-3} centimeters per second (cm/sec) and 6,700 gallons per day per foot (gpd/ft), respectively (ICF Kaiser, 1994).

1.2.5.3 Bedrock

Groundwater within the bedrock system reportedly flows towards the Ohio River. Fluid-level data reported by ICF Kaiser for the KII facility indicate that the bedrock system exists under confined conditions, with a consistent upward hydraulic gradient between the bedrock system and overlying alluvial aquifer. The calculated permeability (fracture flow) of the bedrock unit ranges from impermeable (greater than 1×10^{-9} cm/sec) to 1×10^{-2} cm/sec (ICF Kaiser, 1994). Groundwater elevations measured in alluvial aquifer well R-210 and bedrock well R-310 indicate that an upward hydraulic gradient exists between the alluvial aquifer and underlying bedrock system at this location (Table 2 in the DOCC, Geraghty & Miller, Inc., 1996b).

1.3 Coke Plant Processes

The Steubenville East Coke Plant is comprised of the following four principal operations/process areas:

- Four coke batteries and associated coal and coke storage areas;
- Byproducts Plant and product storage areas;

- Wastewater Treatment Plant; and
- Sinter Plant and associated storage areas.

High-temperature coke is a hard, carbonaceous material produced by coking coal in ovens. Coal, when heated at high temperatures in the absence of air, breaks down yielding a gaseous mixture of water, ammonia, volatile and semivolatile organic compounds, and other constituents as well as a carbon-bearing residue (coke). During the coking process, approximately 25 to 30-percent by weight of the coal becomes mixed gases and vapors that are directed from the ovens to collecting mains that route the gases and vapors to the coal chemical recovery portion of the coking operation (Byproducts Plant).

Coke-oven gas (COG) is composed of hydrogen, methane, ethane, carbon monoxide, carbon dioxide, hydrogen sulfide, ammonia, oxygen, nitrogen and illuminants. Illuminants are unsaturated hydrocarbons such as ethylene, propylene, and butylene. Tar is produced through condensation of the gas and contains general classes of compounds including pyridine, tar acids, naphthalene, creosote oil, and pitch. Ammonia liquor is primarily the water condensing from the gas. It is comprised of free and fixed ammonium salts and phenolic compounds in an aqueous solution. Light oil is generated as a product, which contains benzene, toluene, xylenes and solvent naphthas.

1.3.1 Coal and Coke Storage Areas

Coal to be used in the coking operation is barged to the Steubenville East Coke Plant and is stored in two open pits (the North and South Coal Pits) which occupy approximately 14 acres (Figure 2). No liner materials exist in either of the coal storage pits. Pit depth from land surface is approximately 18 feet. Within the North Coal Pit, a concrete pad has been installed (referred to as Hatcher's Pad) where DTTS has in the past been blended with coal for use in the ovens. Coke that cannot be immediately used is placed in the South Coal/Coke Storage Pit or is temporarily stockpiled in an open storage area in the southern portion of the facility. The coke storage stockpile occupies approximately six acres.

WPSC has received coal for coking from various locations within West Virginia and Kentucky. Representative dry-weight coal and coke analyses for several coal sources between 1991 and 1998 are provided in the following tables:

**Dry-Weight Analyses of Coal
(Percent)**

Coal Type	Eagle	Marfork	Bluestone
Water	6.46	6.79	5.60
Ash	5.90	5.95	4.43
Sulfur	0.86	0.97	0.81
Volatiles	34.76	31.80	18.71
Carbon	59.33	62.25	76.86

**Dry-Weight Analysis of Coke
(Percent)**

COKE	
Water	3.67
Ash	7.70
Sulfur	0.63
Volatiles	0.73
Carbon	91.57

By comparing the dry-weight analyses for the coal and the coke for volatiles, the process of coking the coal predominately liberates the volatiles within the coal. Materials liberated during the coking process make up Coke Oven Gas, which is further processed in the Byproducts Plant.

1.3.2 Coke Battery Description

Currently, the Steubenville East Coke Plant operates four batteries for coking with a total of 224 ovens. Batteries #1, 2, and 3 are three meter Koppers gun flue batteries with 47, 47, and 51 ovens, respectively. These batteries were completed consecutively between 1915 and 1925. Battery #8 is a six meter Koppers under jet battery which contains 79 ovens. Batteries #1, 2, and 3 are the original units installed at the facility and are located in the northwest section of the facility adjacent to the North Coal Pit. Battery #8 is the newest unit which was placed into service in 1976. Battery #8 is located to the east of the South Coal/Coke Storage Pit.

Three other Batteries (#4, #5, and #6) ceased operation in 1976 and have since been demolished. Plans to install Battery #7 were never finalized and as such, Battery #7 was never constructed. The locations of past and present batteries are illustrated on Figure 2.

1.3.3 Coke Battery Operation

Major differences between Batteries #1, 2, and 3 versus #8 include the volume of individual ovens, type of heating system, and the configuration of the COG collection piping. The basic operation of the batteries, however, is similar. Coal charged to the ovens ranges from approximately 12 tons (wet basis) on Batteries #1, 2, and 3 to 33 tons on Battery #8. The coke batteries are heated using fuel gas obtained from the Byproducts Plant. The coking process takes 18+ hours to complete depending on the operating conditions of the battery. Typical coking times for the facility range from 18 - 24 hours. After the coking process is complete, hot cake is pushed with a ram out of the ovens into cake cars where it is quenched with water. Small coke particles (coke breeze) are gravity separated from the quench water and collected via clam bucket for use in the Sinter Plant or sold as a byproduct. Larger pieces of coke are screened and generally loaded directly into rail cars for transport to the WPSC Steubenville and Mingo Junction facilities in Ohio. The screened coke can also be loaded into rail cars or trucks for transport to outside customers or stockpiled on site for later use.

1.3.4 Coking Process Byproducts

As a result of the high temperature heating of coal within the ovens, compounds are released forming a coke oven gas (COG). Coke oven gas driven off during the coking process is cooled with a spray of recycled flushing liquor, and is routed via overhead piping to the Byproducts Plant for further processing. The Byproducts Plant is located to the east of Batteries #1, 2, and 3 (Figure 2).

1.3.4.1 Groups of Hydrocarbons

Four primary groups of hydrocarbons are produced in the coking process: 1) paraffins, 2) olefins, 3) naphthalenes, and 4) aromatics. Paraffins are characterized by the general formula, C_nH_{2n+2} , where n is any integer. Paraffins include methane, ethane, propane, and butane, as well as a series of homologues. Olefins form a homologous series with the general formula, C_nH_{2n} , where n is any integer. The olefin series contains ethylene, propylene, and butylene. Naphthalenes have the same general formula as olefins, but differ in structure. Naphthalenes represent carbon ring

compounds. Aromatics (C_6H_6) represent a major grouping of organic compounds extending from benzene, toluene, and xylenes to phenols, cresols, and multi-ring compounds.

1.3.4.2 Gas-Cooling and Tar Removal

The standpipes for the individual ovens transmit the hot gases through a “gooseneck” which connects the standpipe to a common gas-collecting main for the batteries. As the gas leaves the coke oven at a temperature of between 600 and 700°C, the gas is cooled within the gooseneck by direct contact with a dilute ammonia liquor spray termed “flushing liquor”. Cooling predominately occurs due to adiabatic evaporation of water from the liquor. The flushing liquor is then recirculated back from the main to the tar decanters. The generalized process flow diagram for the coking and byproducts areas is provided as Figure 14 in the DOCC.

Once the gas leaves the collecting main it is saturated with water at a temperature of approximately 75 to 95°C. Most of the tar is condensed from the gas in the collecting mains and is returned with the flushing liquor to the coal tar decanters. In addition to the coal tar, the flushing liquor picks up a portion of the dissolved ammonia along with other constituents from the gas stream. The tar and liquor flow through the crossover mains in contact with the gas and are withdrawn through a downcomer connected to the tar decanters. The decanters are located immediately east of Batteries #1 and 2 (Figure 13 in the DOCC). The decanters are a bank of rectangular shaped steel tanks with a total capacity of approximately 220,000 gallons. There are five tar decanters at the facility.

The mixture of tar and liquor enters one end of the decanter and flows to outlets at the other end. As the material passes through the decanter, it separates into an upper layer of flushing liquor and a lower layer of tar. The liquor flows over a fixed weir to a storage tank and is re-utilized in the gas cooling step. The coal tar is routed to aboveground storage tanks (ASTs) located directly south of the decanters within a concrete containment structure. This coal tar is subsequently sold to other parties including the adjacent Koppers facility. Historically, the coal tar was transmitted by a below ground pipeline which was taken out of service as a result of the coal tar pipeline release between the North and South Coal Pits. A new aboveground transmission pipeline to the Koppers facility has been installed.

Solids and heavy compounds gradually accumulate within the base of the tar decanters and are removed by an automated horizontal scraper system which drops the material into collection hoppers. This material is referred to as decanter tank tar sludge

(DTTS). When disposed of the DTTS is listed as K087 waste; however, all the DTTS is recycled within the plant via the AKJ process.

1.3.4.3 Detarrers, Desulfurization, and Ammonia Removal

The exhausters pull the gases from the ovens through the primary coolers and then push it through the byproducts process. Tar remaining in the gas (tar fog) is removed through tar extractors (detarrers). The detarrers are electrostatic precipitators that create a strong electrical field where gas passing through the field is ionized and suspended particles are charged. The charged particles in the ionized gas are repelled by negative electrodes and precipitate on the positive electrode. This precipitated material is routed to the tar decanters.

The COG is then passed counter currently with ammonia liquor through an absorption tower. Hydrogen sulfide (H_2S) is absorbed into the scrubbing fluid. In subsequent steps, the H_2S is driven from the scrubbing fluid into the vapor phase and combusted to produce SO_2 . The sulfur dioxide is then catalytically converted into SO_3 to produce sulfuric acid. The sulfuric acid is then used to produce ammonium sulfate in the saturators as described below.

The ammonia formed during the coking process exists in both the liquid and gas streams. Ammonia remaining in the coke oven gas is recovered by passing the gas through a bath of dilute sulfuric acid in a device known as a saturator. Ammonium sulfate is produced which is stored as a salt and sold commercially. The commercial-grade ammonium sulfate contains approximately 25-percent ammonia by weight. The ammonium sulfate salt is stored in the Sulphate Storage Room (Figure 13 in the DOCC).

1.3.4.4 Light Oil Separation

The final steps in the byproducts process are associated with the recovery of light oil from the gas. Light oil contains as its principal constituents, benzene, toluene, and xylenes. This light oil is sold commercially by WPSC.

Prior to light oil separation, the hot gas is directly cooled by countercurrent flow with water in the final coolers. The cooling water is recirculated through an indirect cooler. Blowdown from the system is directed into the decanter system.

The process of light oil recovery from coke oven gas involves adsorption using a higher boiling oil (wash oil). The coke oven gas containing the light oil is scrubbed

with the absorbing wash oil in countercurrent scrubbers. The enriched oil from the scrubbers is preheated and introduced into the top of a continuous, bubble-plate column in which the light oil is separated by direct steam distillation. The mixture of light-oil vapor and steam is condensed, and the oil and water are separated. The distilled (debenzolized) wash oil is cooled and returned for use in the light oil recovery process.

Impurities collected in this process that separate during distillation are accumulated for less than 90 days in the 22,000 gallon Muck Tank (Figure 13 in the DOCC) and periodically removed and managed off-site.

In the final step of the light oil recovery process, any remaining water within the light oil is separated and routed to the onsite biological treatment plant. The finished light oil is stored onsite in a 600,000 gallon tank (Light Oil Storage Tank, Figure 13 in the DOCC) pending periodic shipment by barge.

The “polished” gas following the light oil recovery process is routed to an onsite water-sealed gas holder (Gas Holder, Figure 13 in the DOCC) for distribution and use as a fuel source.

1.3.4.5 Coke Oven Gas Pipelines, Drip Legs and Condensate Traps/Tanks

The “polished” gas (COG) within the gas holder is utilized as a fuel at several locations within the Steubenville East Coke Plant. COG is conveyed via aboveground and underground pipes to the coke batteries, the boilerhouse, and the Sinter Plant. Additionally, a transmission line runs to the WPSC Steubenville and Mingo Junction facilities located across the Ohio River. Within the COG transmission lines, variations in temperature occur that results in the formation of vapor condensate. Without removing this condensate, the liquid would accumulate over time and inhibit gas flow. As a result, condensate traps and purge valves (COG drip legs) were installed along the pipeline runs. It is estimated that there are approximately 85 COG drip legs located within the facility boundary. A partial record of drip leg locations is provided as Appendix B. Drip legs exist either aboveground or within access portals below ground based on the pipe run configuration. In the past, the accumulated condensate within twenty-two of the drip legs was discharged directly to the ground. WPSC has modified those drip legs and implemented daily collection of the condensate using a mobile tank truck and returns the liquid to the Byproducts Plant for recycling.

Some analytical data are available for the condensate (see Section 5.3.2). Constituents detected within several drip legs located along the transmission line to the Sinter Plant are summarized below.

Drip Leg Condensate Analysis

PARAMETER	CONCENTRATION (ppm)
Volatiles	
Benzene	32
Toluene	3
EPTOX Metals	
Arsenic	0.139
Chromium	0.20
Mercury	0.003
Selenium	0.299

Additionally, it is known that condensate contains total phenolics and total cyanides. WPSC has estimated that approximately 1,000 gallons of condensate are collected daily from various drip legs throughout the site. In 1998, a new concrete pad was installed on the south side of the tar storage area where the collected condensate is unloaded and recycled back into the byproduct process.

1.3.5 Wastewater Treatment Operations

Process wastewater and runoff collected from the storm sewer is pumped to the Steubenville East Coke Plant wastewater treatment facility (Bioplant). The Bioplant is located east of the major railspur area and west of West Virginia State Route 2 (Figure 2). Wastewater is temporarily stored in three 750,000 gallon aboveground tanks, and subsequently routed to two aboveground biological treatment basins. Discharge from the biological treatment basins is clarified and then routed to the Terminal Treatment Plant for filtration and carbon polishing prior to discharge to the Ohio River via WPSC's NPDES-permitted Outfall Number 005. Approximately 0.6 million gallons per day (mgd) is treated and discharged through the Bioplant and Terminal Treatment Plant. Water sources to the treatment operations include stormwater runoff conveyed from the 500,000 gallon stormwater storage tank located near the North Coal Pit, coal yard drainage, service water, and wastewater from the Byproducts Plant. Figure 15 in the DOCC presents a water balance for the facility prepared by Chester Engineers.

Wastewater is conveyed between treatment units via a combination of aboveground and below ground piping. Wastewater treatment chemicals used include polymers, defoamers, caustic soda, phosphoric acid, and sulfuric acid. Sludge from the biological treatment plant is dewatered with an on-site filter press prior to being transported to a commercial landfill.

1.3.6 Inactive Processes

Two major processes within the byproducts area have been discontinued by WPSC. The majority of equipment associated with both of these processes has been removed. Prior to the mid 1960's, WPSC refined light oil into a number of marketable products including benzene, toluene, and xylene. This process area was located on the northwest side of the facility in what is now an open, grassy area. Additionally, WPSC recovered phenol from the liquid stream until 1975. The locations for these two former operations and other discontinued process or unused structures are provided as Figure 3.

1.3.6.1 Sinter Plant Operation

The Sinter Plant was located on the East Side of the facility and covers approximately 30 acres. The Sinter Plant was idled in May, 1999. Iron ore, limestone, and process residues were combined and heated at this process area to produce a high-iron sinter that was used for iron production. Most of the acreage is associated with raw material storage for the sintering operation and final product storage. A process flow diagram is provided as Figure 16 in the DOCC. The raw materials storage piles consisted of 1) sinter ore, 2) roll scale from steel making at Mingo Junction, 3) blast furnace flue dust and wastewater treatment plant sludge from Steubenville /Mingo Junction, 4) coke breeze, 5) dolomitic limestone, and 6) sinter fines.

Scrubber water from the air pollution control system was recycled. Blowdown from the air pollution control systems were routed to the sinter plant wastewater treatment system for clarification and pH adjustment. Sinter Plant wastewater treatment sludge was returned to the sintering process as feedstock. Sinter Plant wastewater treatment sludge contained small amounts of lead and zinc. Additionally, small amounts of a variety of petroleum products were associated with the roll scale that was brought in and stockpiled from the Mingo Junction facility. This hydrocarbon was volatilized during the raw material heating process.

The hot sinter was moved by truck to the sinter storage area where the sinter was air cooled. Water was sprayed on the sinter to control fugitive dust emissions during

screening and loading operations using existing onsite production well W-15 as the water source. The sinter was then screened and sized and loaded on railcars for shipment to the end users.

1.3.6.2 Former Phenol Recovery

The ammonia liquor from the coal carbonizing process (coking) contains phenol (carbolic acid) and its homologues. WPSC formerly operated a vapor-phase dephenolization process for the ammonia liquor which was housed in the phenol building (Figure 3). In this process, phenols were vaporized by steam. This was accomplished by passing steam through the hot ammonia liquor and then through a solution of caustic soda which absorbed the phenol from the steam. The resulting sodium phenolate liquid was then placed in a springing tank where gas was bubbled through the sodium phenolate. The phenols separated out as a brown, oily layer above the aqueous layer of sodium bicarbonate. Most of the various process tanks have been removed from the phenol building.

1.3.6.3 Former Light Oil Refining Process

Until the mid 1960's, WPSC operated a light oil refining process for the separation of pure benzols, toluols, xylols, and motor benzol from the light oil. The location of this former operation is provided as Figures 3 and 4. The principal refining operation processes involved distillation to separate the light oil fractions based on desired boiling point ranges, coupled with washing the light oil in concentrated sulfuric acid for impurities removal. The boiling points for the principal light oil fractions increase progressively by temperature intervals of approximately 30°C.

Initially, the light oil was washed with sulfuric acid to remove sulfur-containing and unsaturated organic compounds. An agitator was used in the washing process, which created sludge containing the impurities. Following the wash, the light oil was placed in a still and heated (reboiler) resulting in a light-oil vapor. This vapor was contacted with liquid wash oil on bubble plates within a fractionating column. The vapor leaving each plate was progressively richer in the lower boiling point fractions. Within the continuous still operation process, several fractionating columns were used each to remove a specific boiling point range of compounds. The process includes boiling the light oil to create a vapor, fractionating the vapor stream and condensing the resulting fraction into a liquid. A caustic soda solution was used in the process as a neutralizer to counteract the formation of acidic materials within the columns due to sulfur dioxide derivatives. Once fractionated, the material was routed by above and below ground pipes to respective storage vessels. Major process and refined material storage vessels,

which comprised the light oil refining area, are detailed as Figure 4. Most of these structures were removed around 1990.

1.3.7 Power Substations and Transformers

WPSC is a major user of electricity and has a number of substations concentrated within the Byproducts and Sinter Plant areas as well as other areas of the facility. Transformer records are provided as Appendix D in the DOCC. Using the available information included in Appendix D of the DOCC, ARCADIS and WPSC personnel performed a survey of the transformers and capacitors located across the facility during May 1999. Serial numbers were recorded, the presence/absence of PCBs was noted and the location area was described. For purposes of this assessment, those transformers/capacitors labeled as >50 ppm were considered as "PCB containing". The results of the survey, information contained in Appendix D, and input from WPSC personnel have been summarized and are presented as Table 1.

There are currently 21 transformers/capacitors potentially existing at the WPSC facility. Thirteen (13) existing transformers/capacitors are either inside of a building with a concrete floor, or if outside, do not contain PCBs. The status of seven (7) of the transformers/capacitors is unknown; however, in each case the transformers/capacitors is or was either inside of a building with a concrete floor, or if outside, does or did not contain PCBs. All other transformers/capacitors listed in Table 1 have been removed, and in each case (with one exception) the transformers/capacitors were either inside of a building with a concrete floor, or if outside, did not contain PCBs. The status of the last transformer/capacitor listed in Table 1 is unknown; however it is expected that this transformer/capacitor was either inside of a building with a concrete floor, or if outside, did not contain PCBs; WPSC is still evaluating the status of this location.

All of the transformers and/or capacitors identified across the site were either non-PCB containing or were located inside of a concrete base building. Minimal risk is associated with these transformers and/or capacitors regarding the potential for release; therefore, there is minimal risk that these transformers or capacitors resulted in the release of PCBs to the environment. Further investigations with regard to collecting environmental samples in the field are not warranted.

1.4 SWMU Inventory

The location of Solid Waste Management Units (SWMUs) is presented on Figures 5 and 6. The inventory of SWMUs includes former/current aboveground storage tanks (ASTs), former/current underground storage tanks (USTs), transformers, sumps, and current/former process and waste management areas. In addition, 22 Coke Oven Gas (COG) Drip Legs, which formerly discharged to the ground surface are identified with a unique symbol. For the sake of clarity, the drip legs in each sector were assigned the same SWMU identification number, rather than a unique SWMU identification number assigned to each drip leg.

The facility has been divided into eight RFI sectors designated A through H (Figure 5 and 6). The sectors were defined based on similar wastes managed or by similar processes. Each solid waste management unit (SWMU) is identified by a letter, which refers to the RFI sector and then a sequential designation number. Table 2 lists the RFI sector for each SWMU, a description of the SWMU, an identification number for each SWMU, and then whether or not the SWMU is an existing or former structure. Table 3 presents information regarding existing ASTs, USTs, substations and sumps for the Steubenville East Coke Plant.

Each of the RFI Sectors is briefly discussed below.

1.4.1 Sector A: North End

Sector A is located at the northern end of the facility. The most northern portion of this sector (on both sides of West Virginia State Route 2) was formerly leased to Allied Oil Company (Allied) as a Number 6 Fuel Oil Storage Area (SWMU A-1). West of West Virginia State Route 2, two, reportedly four one-million gallon ASTs were used by Allied for fuel storage. The tanks existed prior to 1954 and reportedly were removed in the 1980s. Aerial photographs in Appendix C of the DOCC, indicate that the area to the east of West Virginia State Route 2 was a fuel oil distribution center. SWMU A-1 is suspected of potentially having releases of hydrocarbon to both soil and groundwater. Located directly north of the former tank area there are intermittent seeps of hydrocarbon along the south bank of Mahan's Run.

There are two COG drip legs (SWMU A-14) in the vicinity of the Pipe Bridge that formerly discharged to the ground surface. As stated in Section 1.5, these drip legs are considered areas with potential associated releases identified for further investigation.

Due to the nature of the operations performed, the former Light Oil Refining Area (SWMU A-7) and the former Tank Car Cleaning Area (SWMU A-12) are potentially impacted. These SWMUs are considered areas with potential associated releases identified for further investigation.

1.4.2 Sector B: Byproducts

The Byproducts Area has been used continuously since 1917 for recovering coke oven gas components. This sector has the most SWMUs identified at the facility and is difficult to investigate due to the density of the equipment (both overhead, on the ground and underground) and the many processes that occur here. This Sector is considered an area with potential associated releases identified for further investigation.

A former 6,000-gallon gasoline UST was removed and closed by CE Remediation (1995) in this sector.

There are ten COG drip legs (SWMU B-30) in the Byproducts Plant that formerly discharged to the ground surface. These drip legs are considered areas with potential associated releases identified for further investigation..

1.4.3 Sector C: Batteries

There is one COG drip leg (SWMU C-20) in the batteries area that formerly discharged to the ground surface. These drip legs are considered areas of potential associated releases identified for further investigation.

Other SWMUs associated with the batteries relate to hydraulic oil AST storage and the quench sumps. There have been no known releases from these units to the environment.

1.4.4 Sector D: Pits

This tract contains the coal and coke pits, which occur along the western portion of the facility and as such is mainly a storage area. The Coal Tar Pipeline Release Site (SWMU D-8) has been characterized (see Section 1.6) and is being actively remediated as an interim measures (ARCADIS Geraghty & Miller, 1998a).

The Former DTTS Staging Area (Hatcher's Pad) (SWMU D-2) was used by Mr. Paul Hatcher. Mr. Hatcher's operations involved mixing the DTTS with coal in a cement truck prior to charging the coal in the batteries. The DTTS in the Hatcher's Pad Area was reportedly removed. This area is now covered with a concrete pad. Due to the use of DTTS in this area, this SWMU may require further investigation.

Contaminated fluids have historically discharged into the North and South Coal Pits from the perched water zone. These fluids originate from the adjoining KII facility. The accumulating water is collected and treated prior to discharge. The Coal and Coke Storage Pits are not suspected sources of releases to the environment, however, utilizing existing wells, groundwater downgradient of these areas may be investigated.

1.4.5 Sector E: Storage/Disposal Area

From pre-1965 to 1980, DTTS was disposed of in the BOF Residuals Storage Area. Correspondence dated December 6, 1973 and September 7, 1979 states that this area was receiving 100 tons per month of DTTS, 40,000 tons per month of sludge from the wet scrubber at the basic oxygen furnace (BOF residuals), and varying amounts of other inert waste materials. The disposal of DTTS was discontinued in 1980.

Placement of BOF residuals took place mainly in the more northern end of the excavation (referred to as the BOF Residuals Storage Area), while placement of general mill debris occurred in the more southern end of the excavation (referred to as the Plant Debris Area).

The BOF Residuals Storage Area has been investigated extensively by Geraghty & Miller (1992 and 1994) for purposes of a West Virginia Division of Natural Resources Class F Industrial Landfill Permit Application and for possible recovery of iron and zinc, respectively. Analyses of the BOF residuals were presented in the permit application and are presented in Appendix E-1 of the DOCC.

Borings through the BOF Residuals Storage Area and around the perimeter have defined the areal extent (approximately four acres) and surface and bottom elevations of the BOF residuals. The area has been covered with a protective film that minimizes infiltration while technology to reclaim metals (iron and zinc) from the residuals is being evaluated/developed.

The BOF Residuals Storage Area has a groundwater monitoring network (one upgradient and two downgradient wells) which has been monitored since 1991 (RSA-1 through RSA-3). Some borings installed through the BOF Residuals Storage Area for

the zinc/iron recovery investigation encountered DTTS. Due to the placement of DTTS in this area, this SWMU requires further investigation through sampling of groundwater from the existing monitoring well network (see Section 1.5).

In 1991, the Plant Debris Area was investigated by Geraghty & Miller in support of a West Virginia Division of Environmental Protection Class F Industrial Landfill Permit Application (1991). Analyses of the Plant Debris Area material were presented in the permit application and were presented in Appendix E-2 of the DOCC.

The following is a general summary, based on discussions with plant personnel, of the various types of mill debris generated at the coke plant during the time period from 1972 to 1991 (the time the permit application was prepared):

- Incinerator ash (from the on-site combustion of wood, trash and other combustible debris)
- Furnace brick (e.g., coke oven, boiler house)
- Miscellaneous demolition debris (e.g., concrete, wood, glass, plastic pipe, roofing material, fiberglass insulation, etc.)
- Discarded fugitive raw materials (e.g., coal, limestone, iron ore)
- Discarded fugitive product and production waste (e.g., coke, cinders, ash)
- Cleanup of railroad track debris (e.g., railroad ties, limestone, pellets, coal, coke)

The remaining list of types of material composed a small portion of plant debris in the past:

- Wooden material (e.g., scrap, pallets, chips, sawdust, spools, boxes, etc.)
- Discarded electrical components (e.g., light ballasts, light bulbs)
- Discarded mechanical components (e.g., belts, hoses, cable, etc.)
- Waste metalics (e.g., pipe, scrap steel/aluminum, empty drums, etc.)
- Plant trash (e.g., paper, cardboard, packaging material, paint cans, plastic 5 gallon buckets, soda cans, etc.)

The Plant Debris Area has a groundwater monitoring network (one upgradient and three downgradient wells) which has been monitored since 1991 (PDA-1 through PDA-4). Due to the placement of DTTS in this area, this SWMU requires further investigation (see Section 1.5).

The Former Ash Screening Area (SWMU E-3), operated and leased by WPSC to Mr. Paul Hatcher, was also reportedly used for disposal of DTTS. The DTTS in the Hatcher's Pad Area was reportedly removed. This area is now covered with a concrete pad. Due to the placement of DTTS in this area, further investigation through the analysis of a more comprehensive analyte list for groundwater from the existing well network may be required.

There are seven COG drip legs (SWMU E-4) in this sector that formerly discharged to the ground surface. These drip legs are considered areas with potential associated releases identified for further investigation.

1.4.6 Sector F: Sinter Plant

This sector contains the sinter plant operations, which occur along the southern portion of the facility. Numerous raw materials storage piles are located here. The raw material storage piles are not suspected sources of releases to the environment.

There is one COG drip leg (SWMU F-4) in this sector that formerly discharged to the ground surface. These drip legs are considered areas with potential associated releases identified for further investigation.

1.4.7 Sector G: South End

In this sector, the Former AST Tank Farm and the Closed Sludge Drying Beds are located in the same area (SWMU G-1). At the Former AST Tank Farm there were seven, 20,000 gallon fuel tanks that existed between 1958 and 1976 based on aerial photographs. The Closed Sludge Drying Beds operated until the early 1980s and consisted of two, approximately 60 feet wide by 115 feet long cells. The beds contained excess sludge from the on-site process wastewater treatment plant.

These sludges have been removed from the beds in 1995. The Murphy Consolidated building currently exists at the location of these former beds.

1.4.8 Sector H: Hillside

This sector contains the Former Hillside Disposal Area (SWMU H-1) which requires further investigation (see Section 1.5). Currently, coal tar semi-solids are visible on the ground surface in two locations wicking through the cover material. In addition, steel filings and turnings from benzol scrubber repairs are reportedly buried within the western edge of the disposal area.

In addition, Provenzano Trucking (SWMU H-8) leases an area north of the BOF Residuals Storage Area. Waste may have been managed in this area and it therefore requires further investigation.

In this sector there is also the Closed Sludge Drying Bed (SWMU H-2) which was investigated by Geraghty & Miller in 1991 in support of a West Virginia Division of Natural Resources Class F Industrial Landfill Application. This sludge drying bed was approximately one-third of an acre in size and stored excess sludge from the on-site wastewater treatment plant, which uses an activated sludge process. Excess sludge generated by the treatment plant was transported by truck and placed in the bed. In 1995 sludge was excavated from the area and disposed of off-site. This area has a groundwater monitoring network composed of five wells (SDB-1 through SDB-5). Groundwater quality at this SWMU has been monitored since 1991. An analysis of wastewater treatment sludge is presented as Appendix E-3 of the DOCC.

There is one COG drip leg (SWMU H-12) in this sector that formerly discharged to the ground surface. These drip legs are considered areas with potential associated releases identified for further investigation.

1.5 Nature and Extent of Contamination

This section presents our understanding of the areas with potential associated releases identified for further investigation at the facility. Available information regarding groundwater quality at the facility is also presented and compared to USEPA Region III Tap Water Risk-Based Concentrations (RBCs) for screening purposes only. Potential pathways for migration of contamination and potential impacts on human health and the environment are also discussed.

1.5.1 Monitoring Well Network

There are 34 groundwater monitoring/recovery wells at the facility (not including the wells monitoring the DTTSI, see Figure 2 and 5, and Table 4). There are five wells installed in the perched zone (VP-2, RW-1, RW-2, GM-2T, and GM-3T), 17 wells installed in the alluvial aquifer as previously defined (VA-1, VA-1A, VA-2, VA-3, MW-1, MW-1A, MW-2A, P-1, P-2, R-210, RSA-1 through RSA-3, PDA-1 through PDA-4, and SDB-1 through SDB-5), one well installed into bedrock (R-310), and six recovery wells (PN, PS, RS, RN, KS, KN) installed in fill at the Coal Tar Pipeline Release Site. Of the wells installed at the facility, only the wells installed at the Plant Debris Area [PDA], BOF Residuals Storage Area [RSA], and Closed Sludge Drying Bed [SDB] Area) have been routinely monitored since installation.

1.5.2 Groundwater Quality Data

The following information regarding groundwater quality is presented in Appendix F of the DOCC:

- data for the PDA-, RSA-, and SDB-series wells and the variance wells collected from 1991 through 1997 (DOCC - Appendix F-1);
- data for coal and coke storage runoff and groundwater collected April 12, 1995 (DOCC - Appendix F-2);
- priority pollutant data for R-210/R-310 collected October 5, 1993 (DOCC - Appendix F-3);
- perimeter well monitoring data collected September 1995 (DOCC - Appendix F-4);
- former DTTSI groundwater data from six monitoring events collected from September 1996 through September 1997 (DOCC - Appendix F-5); and
- Byproducts Area Recovery Wells RW-1 and RW-2 data collected July 1995 and October 1997 (DOCC - Appendix F-6).

WPSC reviewed available groundwater data that was historically collected. For those parameters analyzed, the concentrations observed were compared to USEPA Region III Risk-Based Concentrations (RBCs) for Tap Water Ingestion as a screening tool only for a preliminary indicator of general water quality. Constituents that have been detected above RBCs include polyaromatic hydrocarbons (PAHs), ammonia, nitrate, volatile organic compounds (VOCs), and dissolved metals (Table 5). These

constituents are indicative of chemicals produced in the coking and byproducts recovery process. Many of the existing wells can be used as part of the RFI for future groundwater sampling.

1.5.3 Areas With Potential Associated Releases

There are four main areas with potential associated releases at the facility:

- the Former Allied Number 6 Fuel Oil Storage Area (SWMU A-1),
- the Byproducts Area (Sector B),
- COG Drip Legs that formerly discharged to ground (SWMUs A-14, B-30, C-20, E-4, F-4, and H-12),
- areas of DTTS material management:
 - Former DTTS Staging Area/Hatcher's Pad (SWMU D-2);
 - BOF Residuals Storage Area (SWMU E-1);
 - Plant Debris Area (SWMU E-2);
 - Former Ash Screening Area (SWMU E-3); and,
 - Former Hillside Disposal Area (SWMU H-1).

As described below, these areas with potential associated releases identified for further investigation due to the nature of the wastes managed and are proposed for future investigation under the RFI.

1.5.3.1 Former Allied Number 6 Fuel Storage Area

The Former Allied Number 6 Fuel Storage Area (SWMU A-1) contained two, reportedly one-million gallon ASTs and possibly a fuel distribution center. Located directly north of this area there are suspected seeps of hydrocarbon along the south bank of Mahan's Run. Given the age of these units, any product within soil and groundwater has likely weathered and biological degradation and natural attenuation may be occurring.

1.5.3.2 Byproducts Area

Soil borings in the Byproducts Area indicated the presence of residual/floating phase hydrocarbon (ARCADIS Geraghty & Miller, Inc., 1998b). In addition, this area of the

facility (Sector B) is the most active in terms of both past and current processes and waste management. A portion of the Byproducts Area, specifically in the vicinity of the Process Sump, is undergoing active remediation as an Interim Measures. However, the extent of hydrocarbon and other impacts to soil and groundwater needs to be further evaluated in the Byproducts Area.

1.5.3.3 COG Drip Legs

There are 22 COG drip legs (SWMUs A-14, B-30, C-20, E-4, F-4, and H-12) that formerly discharged to ground which are known release points to soil for COG condensate. Since 1992, as much as 1000 gallons per day of COG condensate is collected from the current drip legs. In the past, the COG condensate was released to the ground. Representative analyses of COG condensate are presented in Appendix E-4 of the DOCC. Constituents of concern with this waste are cyanide, phenol, benzene, toluene and metals.

1.5.3.4 DTTS Material Management Areas

WPSC has provided a general time sequence regarding DTTS management from pre-1965 to the present. From pre-1965 to 1980, DTTS was staged in the Former DTTSI prior to disposal at the BOF Residuals Storage Area. From approximately 1980 to 1981, the Former DTTSI was used to store DTTS prior to off-site disposal. From approximately 1981 to 1984, DTTS was stored in hoppers prior to off-site disposal. From approximately 1984 to 1991, DTTS was managed by Mr. Paul Hatcher as described in Section 1.4.4. Since 1991, WPSC has converted its DTTS operations to the AKJ™ process, which mixes proprietary chemicals with the DTTS; the resulting fluid is sprayed directly on the coal on the belt conveyance system for charging at Battery #8.

There are five suspected/known areas of DTTS material management: Former DTTS Staging Area/Hatcher's Pad (SWMU D-2), BOF Residuals Storage Area (SWMU E-1), Plant Debris Area (SWMU E-2), Former Ash Screening Area (SWMU E-3), and the Former Hillside Disposal Area (SWMU H-1). At all of the locations, the DTTS material, if present, is buried. At the disposal area on the Hillside (SWMU H-1), the majority of the DTTS material is covered, however, intermittent "wicking" of small amounts are visible through this cover material. An analysis of the material disposed of on the Hillside is presented in Appendix C. Constituents of concern with this DTTS material are cyanide, metals, benzene, pyridine, and o- and m-cresol.

1.5.4 Hillside Area

During May 1999 several preliminary investigations were performed within Sector H in the vicinity of the Hillside Area “Tar Seeps”. These investigations included:

- Hollow-stem auger soil borings;
- Soil gas sample analysis;
- Surface water sample analysis; and,
- “Tar Seep” sample analysis.

The results of the preliminary investigations are summarized in this section; detailed data results are presented in Appendix C. Appendix C also presents Figure 1, entitled Hillside Assessment Locations, which illustrates that sample locations for the soil borings, the soil gas samples and the surface water samples.

Three soil borings were advanced in the vicinity of the south “tar seep” and one soil boring was advanced in the vicinity of the north “tar seep” area. One soil boring (SB-1) was advanced outside of the south “tar seep” area, indicating that “tar” is present to a depth of 12-feet below ground surface; auger refusal was encountered at 12-feet. Two soil borings (SB-S2 and SB-S3) were placed within the south “tar seep” area. These borings also indicate that “tar” material is present to a depth of approximately 12-feet. One soil boring (SB-N1) was advanced outside of the north “tar seep” area. This soil boring indicates that “tar” is present to a depth of approximately 24-feet.

Soil gas samples were collected from a total of 17 locations across the hillside area. Positive detections for benzene, toluene, xylene and/or naphthalene were observed for six samples. The results were used to delineate approximately the potential extent of subsurface “tar” materials, which is illustrated on Figure 1 presented in Appendix C.

Seven surface water samples were collected in Mahan’s Run in the vicinity of the hillside area as illustrated on Figure 1 presented in Appendix C. Samples were analyzed for VOCs, SVOCs, cyanide, nitrate and ammonia. VOCs and SVOCs were not detected in any of the samples. Nitrate was detected in all of the samples (including the upstream background sample) at concentrations ranging from 0.11 mg/l (SW5) to 8.48 mg/l (Seep 2). Ammonia was detected in 6 of the 7 samples at concentrations ranging from <0.10 mg/l (Seep 2) to 1.49 mg/l (SW4). Cyanide was detected in sample Seep 2 at 0.05 mg/l.

1.5.5 Areas With Minimal Potential Associated Releases

There are three areas with minimal potential associated releases identified for further investigation: the Former Light Oil Refining Area (SWMU A-7), the Former Tank Car Cleaning Area (SWMU A-12), and Provenzano Trucking (SWMU H-8). Analyses from various Former Light Oil Refining Area tanks are presented in Appendix E-6 of the DOCC. These areas with minimal potential associated releases will also require further investigation under the RFI.

1.5.6 Identification of Constituents of Concern

The process of coking and extracting retail byproducts from the liquid and gas streams results in the formation of several major chemical constituent groupings. Most of these constituent groupings are chemicals extracted from the coal during the carbonization process. The major constituents of concern (COC) are polycyclic aromatic hydrocarbons (PAHs), phenolics, and light (volatile) aromatics. The coking and byproducts operation(s) do not result in the formation of several major priority pollutant groupings defined by USEPA which includes 1) chlorinated and nitrogenated organics, 2) phthalates, and 3) pesticides. Therefore, the RFI will not address these three pollutant groupings.

PAHs represent base/neutral extractables, which typically include the following compounds:

Acenaphthene	Benzo(g,h,i)perylene
Acenaphthalene	Dibenzo(a,h)anthracene
Benzo(a)anthracene	Carbazole
Benzo(a)pyrene	Dibenzofuran
Chrysene	Methyl Phenanthrene
Anthracene	Benzo(b)fluoranthene
Fluorene	Napthalene
Fluoranthene	Methylnapthalene
Phenanthrene	Dimethyl napthalene
Pyrene	Benzo(e)pyrene
Benzo(k)fluoranthene	

Phenolics are generated as part of the tar acids and include phenol, methylphenols (cresols), and dimethyl phenols. Volatile organics associated with the process are predominately benzene, xylene(s), and toluene. These constituents originate from the light oil fraction of byproduct processing. Additionally, sulfates, sulfides, cyanides, and metals are present as chemical concentrates from the coking process.

Potential classes of contamination that may be present at the Steubenville East Coke Plant include:

1. Free Tars;
2. Free Light Oils;
3. Organically-contaminated soils;
4. Organically-contaminated surface water;
5. Organically-contaminated groundwater; and,
6. Mixed (organic/inorganic) buried wastes or recyclable products.

1.5.7 Data Objectives of the RFI

The DOCC represents the step in the RCRA Corrective Action process where all existing information is brought forward to develop the site conceptual model and to ascertain major data gaps at the facility. Based on this information, areas of the facility are prioritized based on the waste management activities occurring within these areas, and the potential for these activities to result in releases to the environment. The data gaps are then evaluated within the RFI through the collection of environmental samples from a range of media. The objectives of the RFI are to:

1. Identify the location of contaminants (and media);
2. Assess the factors contributing to the migration of contaminants;
3. Provide the data required to determine environmental and health risks; and,
4. Develop a strategy for corrective measures based on observed site conditions and quantification of risk.

1.5.8 Potential Pathways For Migration of Contamination

1.5.8.1 *Free Product*

Based on known conditions, free coal tar and light oils have been detected at three locations within the facility. Free coal tar is present within the perched water-bearing horizon at the location of the Coal Tar Pipeline Release Site located between the North and South Coal Pits. Free light oils (wash oil) have been detected within the area of the Byproducts Plant. Both of these areas of free product discovery are being addressed specifically through Interim Corrective Measures.

The only other area with observed free coal tar material is the Former Hillside Disposal Area within Sector H where wicking of coal tar semi-solids at land surface have been observed. The nature and extent of the coal tar material in this area will be addressed during the RFI.

1.5.8.2 *Soil Media*

The most industrialized location of the facility is the Byproducts Plant. Limited areas of impacted surface soils appear to exist; however, the extent of these areas is currently unknown.

Land-based waste disposal has taken place at several areas of the facility (BOF, PDA, Hillside). Direct contact with this material (except for the Hillside Area) is limited by cover that has been placed over the waste materials. A soil cover approximately 6 to 12 inches thick has been placed over the PDA disposal area. Originally, a soil-cement mixture was applied over the BOF area to prevent erosion and to preserve the BOF materials in the event that they may be economically recycled in the future. More recently, a spray-on asphaltic cover material (PetroTac®, manufactured by Syntech Products Corp.) has been applied to the surface of the BOF disposal area to prevent erosion. Therefore, direct contact is not likely and disturbance of these wastes is not expected to occur which could potentially create short-term direct exposure to the materials. Direct exposure to “coal tar material” in the Hillside Area is controlled by a chain-link fence and locked gate at each of the two “coal tar material” areas.

1.5.8.3 *Stormwater*

Precipitation contact with impacted soils in the Byproducts Plant may result in contaminant transport via stormwater runoff. Much of the stormwater from this area is collected and directed to the Bioplant for treatment prior to discharge through the

NPDES-permitted outfall. Direct overland discharge of stormwater potentially containing constituents of concern to the Ohio River does not occur for the most industrialized portions of the facility. As a result, the conveyance of contaminants to the Ohio River through stormwater flow is not considered a major pathway.

1.5.8.4 Groundwater

WPSC has initiated the process of evaluating the potential pathways and impacts from groundwater through the performance of a perimeter groundwater monitoring program and baseline risk assessment (Geraghty & Miller, 1996a). Groundwater contamination may result from the potential liberation of contaminants from stormwater, buried wastes, and impacted soils. Some source investigations have been performed to date. Most of the source investigation work has been associated with the following locations:

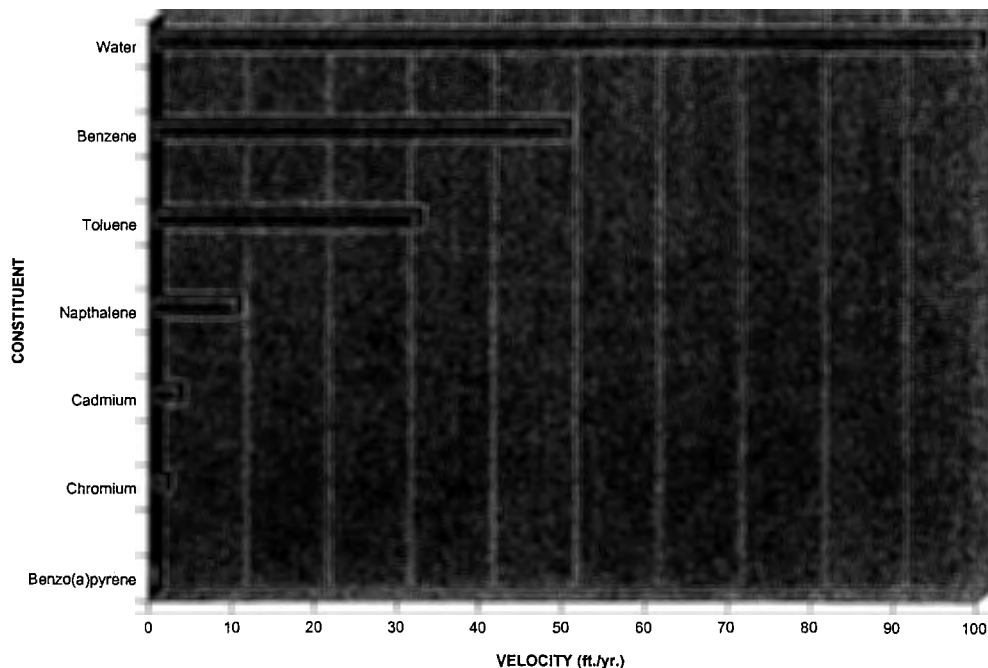
- Closed Sludge Drying Bed;
- BOF Residuals Storage Area;
- Plant Debris Area; and,
- Former DTTSL.

The baseline risk assessment performed in 1996 evaluated groundwater quality at the hydraulically downgradient perimeter of the site (adjacent to the Ohio River). Groundwater monitoring wells within both the perched (one well) and alluvial (seven wells) aquifer zones were utilized in this evaluation. Flow across the facility was determined through the collection of water-level data and plotting of the configuration of flow within the alluvial aquifer zone. The observed chemical concentrations in the perimeter monitoring wells were compared to risk-based standards and resulting concentrations for specific constituents within the Ohio River were calculated based on the mixing of discharging groundwater to the river.

This preliminary analysis concluded that facility-related compounds were present in groundwater at the hydraulically downgradient perimeter of the facility at low levels, and that these constituents did not pose a risk to human health or the environment. This conclusion was based on the fact that drinking water wells are not present at the facility, and the dilutional effects of groundwater mixing with the Ohio River were sufficiently high to eliminate any risks to human health or aquatic life.

The detection of low levels of contamination in groundwater at the hydraulically downgradient perimeter of the facility is to be expected given the age of the Steubenville East Coke Plant. The major chemical constituent groupings associated with the plant processes are amenable to natural attenuation. Abiotic processes, which affect the migration of these constituents, include 1) the interaction of the contaminant with the geologic matrix material (adsorption and ion exchange) or 2) changes in the form of the contaminant due to hydrolysis and redox reactions. Coal tar constituents (PAHs) and metals typically have low solubility levels, which limit the partitioning of the contaminants from soil to groundwater. As an example, the calculated average groundwater flow velocity within the alluvial aquifer at the Steubenville East Coke Plant is 100 feet per year. This is based on a hydraulic conductivity of 22.7 feet per day, a porosity of 20-percent, and a hydraulic gradient of 0.0024 feet per foot. The effective contaminant velocities for a range of site-related compounds will be a fraction of the groundwater flow velocity based on the specific octanol-water partitioning coefficient (K_{ow}). Based on average log K_{ow} values (Montgomery, 1996), the representative contaminant velocities are graphically provided below:

Relative Constituent Velocities



Additionally, biotic processes will occur for the range of PAH compounds potentially present in groundwater. PAH and volatile organic contaminants can degrade through both aerobic and anaerobic processes. Specific metal constituents are also biologically-mediated through complexing. Under specific anaerobic conditions, available sulfates will become reduced and complex with dissolved divalent metallic cations (zinc, lead, and cadmium) in groundwater to form metallic sulfide precipitates.

As a result of abiotic and biotic processes, the types of contaminants associated with the Steubenville East Coke Plant may have limited migration potential via groundwater. This has been observed in data collected at the facility. Within the reports for soil and groundwater quality associated with the former DTTSI (Geraghty & Miller, Inc., 1996b and ARCADIS Geraghty & Miller, 1998c), limited groundwater contamination was observed around this impoundment. Although DTTS residues were noted in soil in contact with perched groundwater within the impoundment, the water-quality data indicate only minor impacts to the groundwater within only several feet of this unit.

Specific field activities will be conducted as part of the RFI within the identified sectors in order to verify information contained herein with respect to migration pathways and to meet the major objectives of the overall RFI process.

1.5.9 Potential Exposure

Residential communities exist at hydraulically upgradient locations to the facility. There are no water-supply wells located on the facility which are used for drinking water. Exposure to site-related contaminants within groundwater is restricted to 1) short-term worker exposure associated with utilities work (if performed), and 2) discharge of contaminated groundwater to Mahan's Run or the Ohio River. As discussed above, the preliminary perimeter groundwater quality assessment and baseline risk evaluation has indicated that the observed contaminant levels are low and that the dilutional effects of groundwater discharge to the Ohio River result in no adverse health or aquatic life impacts with exposure to the river water. Tasks conducted within the RFI will supplement the initial work that has been performed by WPSC.

1.6 Implementation of Interim Measures

On June 29, 1998, WPSC received an Order under Section 3008(h) of the Resource Conservation and Recovery Act, as amended, 42 U.S.C. Section 6928(h) from the United States Environmental Protection Agency (USEPA) Region III (USEPA Docket No. RCRA-III-080-CA) for the Steubenville East Coke Plant. Section VI.A. of the Order specifies that Interim Measures (IM) are required for the Byproducts Plant area and the Coal Tar Pipeline release area. WPSC submitted an Interim Measures Workplan for each of these two locations in July 1998.

1.6.1 Byproducts Plant Area

WPSC operates a process sump in the Byproducts Area, which collects waste fluids from the Byproducts Area and reroutes the fluids back into plant processes or to treatment. Concurrent with excavation of this area in order to repair and line the sump, WPSC discovered the presence of separate-phase hydrocarbons in the vicinity of the process sump. In response to this discovery, WPSC installed original recovery wells RW-1 and RW-2, which were galvanized pipe perforated with torch-cut slots surrounded by clean backfill. The recovery wells were installed within the perched groundwater zone.

In September 1995, these recovery wells were replaced by better-constructed recovery wells, RW-1 and RW-2 (Figure 2 and 5). In October 1997, these wells were equipped with total fluids recovery systems. The recovery systems are designed to maintain fluid levels in the recovery wells at the top of the recovery pump intake, thereby removing any separate-phase hydrocarbons on the groundwater, if present.

In the past, replacement recovery well RW-2 contained separate-phase hydrocarbons ranging from 0.05 to 0.55 feet. Replacement recovery well RW-1 has never contained separate-phase hydrocarbons. Although RW-1 does not contain separate-phase hydrocarbons, both recovery wells were fitted with total fluids pumps to facilitate recovery of separate-phase hydrocarbons and impacted groundwater. The operation of the total fluids recovery pump in RW-1 may induce hydrocarbon flow to the well over time.

The recovery system has removed more than 60,930 gallons and 235,490 gallons of impacted groundwater from RW-1 and RW-2, respectively, and the water has been routed to the Byproducts system and ultimately to the Bioplant for treatment. WPSC will continue to operate the total fluids recovery systems in RW-1 and RW-2 as required by the Order.

Water-quality conditions in the vicinity of wells RW-1 and RW-2 have been characterized by two sampling events conducted in July 1995 and October 1997. Analytical results from these sampling events indicate that dissolved constituents from hydrocarbons and other sources have impacted groundwater in the vicinity of the Byproducts Area.

1.6.2 Coal Tar Pipeline Release Site

During May 1996, WPSC personnel observed coal tar seepage at the location of a leak in an underground portion of the coal tar transfer line that passes through a dike located between the North and South Coal Pits (Figure 7). The pipeline was repaired and observable coal tar was recovered using a vacuum truck. On May 30, 1996, WPSC installed four test pits in an effort to recover as much coal tar as possible from the area. Then, on May 31, 1996, WPSC installed steel collection sumps into three of the test pits where coal tar was present and initiated removal actions until coal tar was no longer observed.

In July 1996, WPSC delineated the horizontal and vertical distribution of coal tar within the shallow fill deposits by conducting a soil boring program. Based on information collected during the soil boring program, WPSC installed six recovery wells in September 1996. Coal tar recovery operations from the recovery wells have been ongoing since September 1996. Historically (1996), the greatest accumulations of coal tar have been noted for wells RS, RN, and PS (4.9, 1.3, and 4.6 feet, respectively). Only traces of coal tar have been noted in recovery wells PN, KS, and KN. Based on the observed release conditions over the past several years, the coal tar appears to be areally restricted and recoverable coal tar exists only within three of the recovery wells.

Based on the work performed to date, the extent of coal tar contamination due to the pipeline leakage has been delineated. The underground pipeline was taken out of service in 1998. The pipeline was cleaned and plugged. An aboveground replacement pipeline running from the Byproducts Plant to the KII facility has been installed and is now used to convey coal tar to KII for processing.

WPSC performed coal tar accumulation testing in wells PS, RN, and RS to provide information on the rate of coal-tar product accumulation. The results indicated that well PS accumulates coal tar that is predictable and sufficient for automated recovery, however, the coal tar thicknesses measured in wells KS, KN, RS and RN were less than desirable for an automated recovery system.

WPSC performed an automated coal tar recovery pilot test in well PS. Based on the results of this testing a conceptual design for an automated coal tar recovery system has been prepared and was submitted to USEPA in a report dated January 7, 1999.

1.6.3 Additional Interim Measures

Based on the review of plant operations, waste management, and current site conditions as provided within the DOCC, no additional locations at the facility require Interim Measures. Areas with potential associated releases will be investigated as part of the RFI and based on the results and interpretations of risk, corrective measures will be implemented as necessary.

1.7 Technical Approach To Site Investigation

The Wheeling-Pittsburgh Steel Corporation (WPSC), Steubenville East Coke Plant is a large, heavily industrialized facility that has been in operation since 1917. Past and current operations at the facility include the production of metallurgical-grade coke for use in steel production, the processing of coke-oven gas in the Byproducts Plant, treatment of generated wastewater, and production of iron ore supplement at the Sinter Plant from recycled materials. Due to the size of the facility (588 acres) and the complexity of the industrial operations, the Steubenville East Coke Plant has been divided into eight sectors (Sectors A through H) for investigative purposes. These sectors were defined based on similar wastes managed or by similar processes within the area. For each sector, WPSC identified Solid Waste Management Units (SWMUs) that have had the potential to impact the environment. This includes aboveground and below-ground tanks, sumps, transformer/capacitor locations, raw material storage, and waste/recycle material management.

It is the intent of WPSC to assess the environmental conditions at each sector, rather than at each individual SWMU. WPSC intends to adopt a two-pronged approach for the RFI. WPSC will investigate those areas identified as potential releases to the environment, in conjunction with an "outside-in"/perimeter investigation by sector. This approach accomplishes the goals of targeting those areas with potential associated releases identified for further investigation and focusing WPSC resources at this large, complex facility to other areas within each sector, which may require additional assessment.

The proposed field activities for the RFI represent Phase I activities only. It is feasible that Phase II activities may be required. The scope of Phase II activities would be determined based on the results of the Phase I activities. Phase II activities could include:

- Additional groundwater monitoring wells;
- Additional groundwater quality analysis; and/or,
- Treatability testing.

The proposed Phase I field activities are focused on the perched groundwater aquifer and the alluvial groundwater aquifer. The proposed Phase I field activities do not address surface water at the Ohio River or bedrock groundwater. The Ohio River and bedrock groundwater media will be addressed as part of Phase II only, if determined to be appropriate and necessary.

Many of the RFI sectors will be investigated utilizing geoprobe sampling techniques. If geoprobe techniques cannot be utilized due to subsurface obstructions or other difficulties, hollow-stem auger techniques will be utilized. Geoprobe borings will extend to the uppermost saturated zone (whether perched or alluvial), but will not penetrate through the perched zone into the alluvial aquifer. If product is encountered during Phase I field investigation activities, the Phase I field program will be expanded so that the extent can be assessed using geoprobe or other techniques

The areas of suspected contamination identified within this Description of Current Conditions (DOCC) document are the:

- Former Allied Number 6 Fuel Oil Storage Area (SWMU A-1);
- Byproducts Area (Sector B);
- COG Drip Legs that formerly discharged to ground (SWMUs A-14, B-30, C-20, E-4, F-4, and H-12); and
- Decanter Tank Tar Sludge Material Management Areas
 - Former DTTS Staging Area/Hatcher's Pad (SWMU D-2)
 - BOF Residuals Storage Area (SWMU E-1)
 - Plant Debris Area (SWMU E-2)
 - Former Ash Screening Area (SWMU E-3)
 - Former Hillside Disposal Area (SWMU H-1)

The other areas of potential contamination identified within this DOCC are the following:

- Light Oil Refining Area (SWMU A-7);
- Former Tank Car Cleaning Area (SWMU A-12); and
- Provenzano Trucking Leased Parcel (SMWU H-8)

WPSC has utilized information gained through past environmental assessment activities (as summarized within the DOCC and this workplan) in the formulation of the scope of work for the RFI. Many areas of the facility are currently and have historically been used for the storage of coal and metallurgical-grade coke. Because of the physical properties of these materials, they are not likely to be sources of release to the environment. These materials are not viewed as contributing significantly to potential sources of releases to the environment. Therefore, these areas will be investigated using existing hydraulically downgradient groundwater monitoring wells.

Given the nature of the operations, specific areas of the facility with suspected contamination typically have a high concentration of solid waste management units. The individual assessment of each of these units is neither practical nor an effective method of producing data designed to meet the RFI objectives identified in Section 1.5.7. Instead, a grouping of units within a given sector will be assessed, and if required, supplemental investigations would be conducted to ascertain whether a particular unit represents a source. Given the age of the facility and the latency of many of the chemical contaminants, identified releases to the environment may not reflect a recent or continuing release. WPSC intends on building onto the work accomplished in 1996 referred to as the perimeter environmental baseline investigation and preliminary risk assessment. The two-pronged approach to the assessment of environmental conditions at the facility will focus WPSC resources where needed, while ensuring that risks to human health and the environment are adequately protective.

1.8 Task Plan for RFI

The RFI has been divided into the following six major tasks:

- Task 1 – Development of Workplans

- Task 2 – Field Investigations
- Task 3 – Human Health Risk Assessment
- Task 4 – Ecological Risk Assessment
- Task 5 – Treatability Study/Pilot Testing
- Task 6 – RFI Reporting

1.8.1 Task 1 – Development of Workplans

Task 1 consists of the preparation of this RFI Workplan. The RFI Workplan provides the approach and methodologies to be implemented during the RFI. These documents serve as the baseline to control the quality of the work performed and focuses the intent of the project on the stated objectives.

The majority of information regarding site background, physical setting, and initial evaluation are incorporated from the DOCC. The deliverables for Task 1 include the development of a Project Management Plan, a Data Collection Quality Assurance Plan, a Data Management Plan, a Community Relations Plan, and a Health and Safety Plan.

1.8.2 Task 2 – Field Investigations

The available environmental data collected to date was reviewed during preparation of this RFI Workplan. Additionally, several site reconnaissance visits were performed to locate the existing well network and assess existing physical conditions at facility Site. The following field investigation activities are designed to provide sufficient data to meet the investigation objectives.

The proposed field investigations include collecting soil, ground-water, surface water/sediment and “tar” seep data. The proposed field activities are summarized in Tables 6 and 7 and are illustrated on Figures 5 and 6. The proposed Phase I field activities are focused on the perched groundwater aquifer and the alluvial groundwater aquifer. The proposed Phase I field activities do not address surface water at the Ohio River or bedrock groundwater. The Ohio River and bedrock groundwater media would be addressed as part of Phase II only, if determined to be appropriate and necessary.

Many of the RFI sectors will be investigated utilizing geoprobe sampling techniques. If geoprobe techniques cannot be utilized due to subsurface obstructions or other difficulties, hollow-stem auger techniques will be utilized. Geoprobe borings will extend to the uppermost saturated zone (whether perched or alluvial), but will not penetrate through the perched zone into the alluvial aquifer. If product is encountered

during Phase I field investigation activities, the Phase I field program will be expanded so that the extent can be assessed using geoprobe or other techniques.

Environmental samples will be submitted to an analytical laboratory for analysis as described in the following field investigation subtasks. The rationale for the choice of sampling parameters and protocol is summarized in Section 1.8.2.14 entitled, Overview of Sampling Program and further detailed in the Data Collection Quality Assurance Plan. Detailed field procedures are also presented in applicable sections of the Data Collection Quality Assurance Plan and Appendix E, entitled, Standard Operation Procedures.

The subtasks included in the field investigation task include:

- Subtask 2.1 - Geoprobe Soil Borings/Groundwater Samples
- Subtask 2.2 – Soil Sampling/Groundwater Monitoring Well Installation
- Subtask 2.3 – Hillside Soil Gas Sampling
- Subtask 2.4 – Hillside Soil Borings and Wells
- Subtask 2.5 – Survey Wells and Mahan’s Run
- Subtask 2.6 – Sample “Tar” Seeps
- Subtask 2.7 – Water Level Measurements
- Subtask 2.8 – Monitoring Well Development
- Subtask 2.9 – Surface Soil Sampling
- Subtask 2.10 –Groundwater Sampling
- Subtask 2.11 – Surface Water/Sediment Sampling
- Subtask 2.12 – Slug Testing
- Subtask 2.13 – Environmental Site Assessments

The following discussion presents an overview of the field investigation tasks. Details regarding the investigation procedures and protocols can be found in the Data Collections Quality Assurance Plan.

1.8.2.1 Subtask 2.1 - Geoprobe Soil Borings/Groundwater Samples

Up to 31 geoprobe soil borings will be advanced across the site at locations that correspond to specific target areas within each Sector (Figure 5 and 6, Table 6 and 7) as follows:

- Sector A – 11 geoprobe locations
- Sector C – 1 geoprobe location
- Sector D – 1 geoprobe locations
- Sector E – 8 geoprobe locations
- Sector F – 1 geoprobe location
- Sector G – 2 geoprobe locations
- Sector H – 6 geoprobe locations

Each boring will be advanced until the uppermost water-bearing zone is encountered, but will not be advanced through the perched aquifer zone into the alluvial aquifer zone. Continuous cores will be collected and inspected in the field. Each core will be screened for potential volatiles using a photo-ionization detector (PID).

To determine concentration profiles, soil samples from at least two and perhaps three intervals (near surface, mid-point and above the uppermost water-bearing zone) will be collected and submitted for laboratory analysis. The near surface soil sample will be collected from the top 12 inches of soil. The deeper soil sample(s) will be selected using visual observations and PID readings. A soil sample from the mid-point will not be collected and submitted for laboratory analysis unless visual observations and/or PID reading indicate contamination. If geoprobe techniques cannot be utilized due to subsurface obstruction, hollow-stem auger techniques will be attempted.

All geoprobe soils samples will be for modified Target Compound List (TCL) constituents. An overview of the analytical program is presented in Section 1.8.2.14. Soil samples will not be collected from the geoprobe boring at Sector E-3 Former Ash Screening Area.

Sample collection for VOCs will follow procedures outlined in USEPA Method 5035 for natural fine-grained soils. For natural soils with large rock fragments or cobbles, or for fill materials (slag, etc.) that are not conducive to sampling with a syringe or Encore

sampler, samples will be collected by using the procedure described in SOP Nos. 3 and 4 in Appendix E.

A groundwater sample will be collected from each Geoprobe location using Geoprobe groundwater sampling techniques. If this methodology is not successful, a temporary small diameter well may be installed using the existing geoprobe borehole, or if necessary, a hollow-stem auger hole will be advanced so that a temporary well can be installed. The parameter list for groundwater samples will be the same as for the soil samples for each geoprobe location, except that a suite of biogeochemical parameters will be added as described in Section 1.8.2.14 entitled, Overview of Analytical Program.

1.8.2.2 Subtask 2.2 –Soil Sampling/Groundwater Monitoring Well Installation

A total of 34 groundwater monitoring wells will be installed using hollow-stem auger techniques at the following locations, which are illustrated on Figures 5 and 6 and detailed in Tables 6 and 7:

- Sector B – 8 cluster well locations - 19 wells
- Sector C – 4 cluster well locations – 8 wells
- Sector D – 3 cluster well location – 7 wells

A hollow-stem auger soil boring will be advanced until the uppermost water-bearing zone is encountered, but will not be advanced through the perched aquifer zone into the alluvial aquifer zone. This soil boring will be converted into either a perched aquifer zone monitoring well or an upper alluvial aquifer zone monitoring well as described in Section 2.0 entitled, Data Collection Quality Assurance Plan (see Figure 8). Continuous split-spoon samples will be collected and inspected in the field. Each core will be screened for potential volatiles using a photo-ionization detector (PID).

To determine concentration profiles, soil samples from at least two and perhaps three intervals (near surface, mid-point and above the uppermost water-bearing zone) will be collected and submitted for laboratory analysis. The near surface sample will be collected from the top 12 inches below ground surface. The deeper soil sample(s) will be selected using visual observations and PID readings. A soil sample from the mid-point will not be collected and submitted for laboratory analysis unless visual observations and/or PID reading indicate contamination. One soil sample will also be collected from the confining layer that separates the perched and alluvial aquifers at

each nested well location. Soil samples will be submitted for analysis for the modified TCL as detailed in Section 1.8.2.14, which provides an overview of the analytical program.

Sample collection for VOCs will follow procedures outlined in USEPA Method 5035 for natural fine-grained soils. For natural soils with large rock fragments or cobbles, or for fill materials (slag, etc.) that are not conducive to sampling with a syringe or Encore sampler, samples will be collected by using the procedure described in SOP Nos. 3 and 4 in Appendix E.

At each location a second borehole will then be advanced using hollow-stem augers for the purpose of installing a steel surface casing into the fine-grained zone that separates the perched aquifer zone and the alluvial aquifer zone. Continuous split-spoon sampling will be initiated at a depth consistent with the depth that split-spoon sampling was terminated for the first soil boring. This boring would be used to install an upper alluvial aquifer monitoring well.

At four locations (3 in Sector B and 1 in Sector D – see Figures 5 and 6) a third borehole will be advanced using hollow-stem augers for the purpose of installing a monitoring well in the lower alluvial aquifer zone. Steel surface casing will again be installed and keyed into the middle or lower portion of the alluvial aquifer zone. Continuous split-spoon sampling will be initiated at a depth consistent with the depth that split-spoon sampling was terminated for the second soil boring.

Up to six (6) split-spoon sample locations will be collected to characterize the aquifer hydraulic properties. Two samples each will be collected from the perched aquifer zone, the upper alluvial zone and the lower alluvial zone and submitted for:

- Porosity;
- Grain size;
- Moisture content;
- Total organic carbon; and,
- Bulk density.

In addition, two shelly tube and two split-spoon samples will be collected from the aquitard separating the perched aquifer zone and the upper alluvial zone and analyzed for the following list of parameters:

- Porosity;
- Grain size;
- Moisture content;
- Total organic carbon;
- Bulk density; and,
- Permeability.

The location and depth of each sample will be determined in the field with the objective of identifying sampling locations that are representative of conditions across the site.

1.8.2.3 Subtask 2.3 – Hillside Soil Gas Sampling

Up to 30 soil gas samples will be collected across the hillside area to further delineate the potential presence of subsurface materials containing organic constituents. Soil gas sampling locations will be determined in the field. They will be concentrated in the vicinity of the north and south “tar seep” areas. Samples will also be collected in the open field and wooded areas to obtain full coverage across the hillside area. All samples will be collected and analyzed for VOCs and SVOCs.

1.8.2.4 Subtask 2.4 – Hillside Borings and Wells

Up to 20 geoprobe soil borings will be advanced in the hillside area to investigate the potential presence of “tar” beneath the subsurface and to characterize the depth and type of fill material (Figure 5, Tables 6 and 7). These soil borings will be used to confirm the results of the soil gas sampling task and placement of these borings will be determined in the field. Continuous core sampling will be performed and the samples will be logged and characterized in the field using a PID. No soil samples from the geoprobe sampling will be submitted for laboratory analysis. If difficulty is encountered using the geoprobe technique (e.g., refusal), a hollow-stem auger drilling rig may be used to complete the geoprobe soil boring task.

Four shelly tube samples and 4 grab samples will be collected in the vicinity of the north and south “tar seep” areas for geotechnical analysis to be used for potential stability and/or treatability analysis. The locations and depth of these samples will be determined in the field based on observations noted during the geoprobe soil boring program.

Six hollow-stem auger borings will be advanced at the approximate locations illustrated on Figure 5 to determine the depth of waste and the nature of fill material across the hillside area. Soil samples will be logged in the field and screened using a PID. Soil borings will be advanced until refusal is encountered. No soil samples from these borings will be submitted for analytical analysis.

Five two-inch diameter, PVC groundwater monitoring wells will be installed in the uppermost water-bearing zone encountered at locations illustrated on Figure 5. Hollow-stem auger borings will be advanced along with continuous split-spoon sampling to determine the characteristics of the hillside material and the depth to water.

1.8.2.5 Subtask 2.5 – Sample “Tar” Seeps

Two samples, one from the north “tar seep” area and one from the south “tar seep” area will be collected and analyzed for modified TCL, TCLP and hazardous characteristics as presented in Section 1.8.2.14.

In addition, one sample from the “tar seep” along the hillside adjacent to Mahan’s Run in the vicinity of Sector A will be collected and analyzed for modified TCL as presented in Section 1.8.2.14.

1.8.2.6 Subtask 2.6 – Survey Wells and Mahan’s Run

Following the installation of the monitoring wells, each well will be surveyed for horizontal and vertical control. At each location, the elevation of ground surface, inner casing and outer casing will be surveyed. The vertical datum to be used will be mean sea level, which will be taken from an on-site bench mark, to be identified by WPSC. Horizontal datum will be tied to the State Plane Coordinate System. The survey will be performed by a West Virginia licensed surveyor and will be to the nearest 0.01 foot accuracy. In addition to the new monitoring wells, all existing monitoring wells and proposed geoprobe and surface soil sample location will be surveyed for both horizontal and vertical control.

Up to three locations along Mahan’s Run, and two locations on the Ohio River, will also be surveyed for vertical and horizontal control to aid in the development of a groundwater flow map.

1.8.2.7 Subtask 2.7 – Water Level Measurements

Water level measurements will be collected several times in each well, as appropriate during the field investigation. At a minimum, one full round of water-level measurements will be collected from each of the existing and newly installed wells (approx. 81) across the site. Each well will also initially be checked for the presence of separate phase product. The water elevation at the three surveyed points along Mahan's Run and two survey points along the Ohio River will be measured and recorded during each round of groundwater level measurements. Water level measurements will be used to develop potentiometric contour maps and to verify the direction of groundwater flow.

1.8.2.8 Subtask 2.8 – Well Evaluation/Development

The groundwater sampling program will include the sampling of existing wells that in some cases have not been sampled for several years. The condition and integrity of the existing wells is unknown. Therefore a survey of the existing wells will be performed to determine the condition and integrity of the existing wells. Those wells that are determined to be in satisfactory condition will then be developed in order to ensure that representative groundwater samples can be obtained during the groundwater sampling event(s). The following mechanical methods may be used, as necessary, to develop each well:

- Submersible pump;
- Large diameter PVC bailer
- Surge block; and/or
- Hand pump.

Groundwater will be removed from each well using one or a combination of the withdrawal techniques listed above until the water is clear and sediment free, to the extent practicable. During development pH, specific conductance and turbidity (measured with a turbidity meter as described in SOP No. 16 in Appendix E) will be monitored and used as a gauge for when development is complete.

1.8.2.9 Subtask 2.9 – Surface Soil Sampling

A total of 46 surface soil samples will be collected using geoprobe and hollow-stem augers techniques as described in sections 1.8.2.1 and 1.8.2.2 presented above. Each

geoprobe and/or hollow-stem auger drilling location described in the tasks above are also associated with collecting a groundwater sample at that location. Surface soil samples will also be collected at three (3) locations in Sector F and two (2) locations in Sector G using hollow-stem augers to assess potential risk associated with exposure to constituents in the surface soil media in these areas. Background surface soil samples will be collected at five (5) locations in the Hillside Area (Sector H) at locations illustrated on Figure 5.

All surface soil samples will be collected from the 0- to 1-foot depth. All surface soil samples will be logged in the field and screened with a PID for volatiles. Samples will be analyzed for the modified TCL of constituents.

1.8.2.10 Subtask 2.10 – Groundwater Sampling

One groundwater sampling event will be conducted to characterize water quality conditions at the facility. A comprehensive groundwater sampling event will be performed which will include new and existing monitoring wells that are illustrated on Figures 5 and 6. A total of 60 locations will be sampled as follows:

- Sector B – 19 new wells, RW-1 and RW-2
- Sector C – 8 new wells, R-210 and R-310
- Sector D – 7 new wells, VA-1, VA-1A, VP-2 and VA-2
- Sector E – RSA-1, thru RSA-3, PDA-1 thru PDA-4
- Sector F – VA-3, P-1, TDI-D, TDI-S and TDI-P
- Sector G – MW-2A
- Sector H – 5 new wells

Low-flow sampling techniques will be used to collect a representative groundwater sample from each well. All purge water will be containerized and handled as described in the Data Collection Quality Assurance Plan (DCQAP). All samples will be analyzed for the modified TCL and biogeochemical parameters as described in Section 1.8.2.14. Metals analysis will be performed on non-filtered samples (total metals), with the exception of manganese, which will be performed on field filtered samples (dissolved metals). If the turbidity of the water being withdrawn from the well during sample exceeds 5 NTU, a field filtered sample will also be collected for dissolved

metals. Each well will be gauged prior to sampling for the presence/absence of free product (i.e., LNAPL and DNAPL). A groundwater sample will not be collected from those wells containing free product.

1.8.2.11 Subtask 2.11 – Surface Water/Sediment Sampling (Mahan's Run)

One round of surface water/sediment samples will be collected at locations illustrated on Figure 5. Surface water/sediment sampling will provide quantitative and qualitative data concerning the degree, nature and extent of constituents in Mahan's Run.

Background or upgradient sampling locations regardless of the media should be in a "clean" area so that they may provide representative background quality in the media of concern. Samples should be collected in the same environmental setting as the downgradient sampling locations, to the extent practicable, as the downgradient sampling locations, unless the media of concern changes rapidly across the site. For example, an upgradient sediment sample should not be collected in sandy soil types if the downgradient samples are collected from clay soil types. Location of the sampling points should also consider surface runoff, agricultural and industrial activities that may be affecting the quality of the upgradient sampling locations. As a result, the constituent concentration measured at each of these upgradient sampling locations will represent "background" levels, to the extent possible.

The objective of the surface water/sediment sampling task is to determine if any alteration of Mahan's Run has occurred as a result of constituents potentially released from the Hillside Area. Thirteen surface water/sediment samples will be collected and analyzed for a modified TCL as described in Section 1.2.8.14 (Tables 6 and 7). Additional laboratory analysis will be performed on surface water and sediment samples. Additional laboratory analysis for surface water samples will include:

- Total suspended solids (TSS);
- Total dissolved solids (TDS);
- Biological oxygen demand (BOD);
- Chemical oxygen demand (COD);
- Total Organic Carbon (TOC);
- Alkalinity; and,
- Hardness.

In addition, sediment samples will be analyzed in the laboratory for:

- TOC;
- Grain size;
- Percent Moisture; and,
- Percent Solids.

1.8.2.12 Subtask 2.12 – Slug Testing

Slug tests will be performed on 18 monitoring wells, including 12 new wells to be installed as part of the RFI and 6 existing wells: six in perched aquifer zone wells, six in upper alluvial aquifer wells and six in lower alluvial aquifer wells. These tests serve an important function in determining the interconnection of aquifer zones and provide design information for potential remedial scenarios, should corrective action be deemed necessary.

The wells to be tested will be selected after well installation is complete and will be based on observations noted during soil boring advancement and well installation. The objective will be to select three wells within a given aquifer zone that will provide a representative cross-section of conditions across the site within that given zone.

Slug-in tests will be performed on wells when the water level is at least 3 feet above the top of the screened interval in the well. Slug out tests will be performed in wells when the water level is below the 3-foot mark above the top of the well screen. A single channel transducer will be used to record background water level measurements and changes due to the slug in and slug out phases of each test. The data will be interpreted using Aqtesolv™ which is the industry-accepted software standard for slug test analysis.

1.8.2.13 Subtask 2.13 - Environmental Site Assessment

Phase I Environmental Site Assessments will be completed for the following areas of concern:

- H-8 Provenzano Trucking,
- H-10 PGT Trucking; and,
- H-11 Murphys Consolidated Industries

The Phase I Environmental Site Assessments will be conducted in accordance with American Society of Testing and Materials (ASTM) Guidance Document E1527-94 for conducting Phase I Environmental Site Assessments, and will include the following general tasks.

- An inspection of the grounds and structures and an evaluation of the surrounding properties will be performed to identify areas of potential environmental impairment. The scope of this section will include but not be limited to: site history and former usage, underground and aboveground storage tanks, suspect PCB and asbestos containing materials, chemical, medical, and regulated waste disposal.
- Interviews with site representatives or others familiar with past and present activities, which will include a review of an environmental questionnaire.
- Historical documents will be reviewed to obtain information on historical property use. The documents reviewed will include, but not be limited to, the following: aerial photographs, Sanborn™ Fire Insurance Maps (if available), geotechnical map information, and available environmental quality data for the site.
- A review of the available federal, state, and local documents relevant to the environmental quality and subsurface conditions in the area will be conducted. This will include: spill logs, regulatory records, publications, and geotechnical information. This review will encompass a 1 mile radius of the property and include the following databases: National Priorities List (NPL), Facility Index System (FINDS), Comprehensive Environmental Response and Compensation Liability Information System (CERCLIS), Resource Conservation and Recovery Act (RCRA) notifiers, Emergency Response Notification System (ERNS), State Inactive Hazardous Waste Sites, and State Registered and Leaking Underground Storage Tank Facilities.
- Two geoprobe soil borings will be advanced at the Murphy Consolidated Industries leased property, as close as possible to the former sludge drying beds. The necessity for additional borings will be based on the results of the Phase I environmental assessment activities described above. Three soil samples will be collected at each boring location (i.e., near surface, mid zone and just above the uppermost water-bearing zone). In addition, one (1) groundwater samples will be collected at each geoprobe location.
- Four (4) geoprobe soil borings will be advanced at the Provenzano Trucking Company leased property. The location of these borings will be based on the

results of the Phase I environmental assessment activities described above. Three soil samples will be collected at each boring location (i.e., near surface, mid zone and just above the uppermost water-bearing zone). In addition, one (1) groundwater samples will be collected at each geoprobe location.

The scope of work in this Environmental Site Assessment will not include:

- Sampling or analysis of waste or air.
- Sampling of potential asbestos containing material.
- Chain-of-title information to evaluate previous land usage for a period of up to 50 years past.

The findings will be summarized in a written section of the RFI report. Recommendations will be provided, which will include additional investigations, as necessary.

1.8.2.14 Overview of the Analytical Program

The sampling programs discussed in the previous sections will generate surface water/sediment, soil and groundwater samples for laboratory analysis of the selected chemical constituents of concern. The analytical program and the selected chemical parameters of concern are outlined in Tables 6 and 11.

Parameters and/or constituents to be analyzed for will vary depending on the media and location of a given sample, as presented in Tables 6 and 7. Samples will be analyzed for a modified version of the Target Compound List (TCL) specified in EPA SOW OLM032. The TCL has been modified to eliminate the analysis of pesticides/PCBs, since these constituents are not reasonably expected to be present in the media at the site. In addition, based on discussions with USEPA, the following constituents have been added to the TCL:

- Acetophenone;
- Aniline;
- Acetonitrile;
- Pyridine;
- Bis(2-chloroisopropyl) ether;

- Butyl benzyl phthalate;
- N-nitroso-di-n-propylamine;
- Cyanide;
- Ammonia; and
- Sulfide.

All groundwater samples will also be analyzed for a list of biogeochemical parameters as presented below to evaluate the biodegradation processes that are likely occurring. Four surface and/or subsurface soil samples from the Hillside area will be analyzed for a list of geotechnical parameters as presented below. In addition to the modified TCL, surface water samples will be analyzed for a list of indicator parameters presented below. In addition to the modified TCL, sediment samples will be analyzed for total organic carbon and physical parameters presented below.

The following parameter groups and or constituents will be analyzed for depending on the media and sampling location:

MODIFIED TARGET COMPOUND LIST OF CONSTITUENTS

- VOCs – SW-846
 - Surface and Subsurface Soil
 - Groundwater
 - Surface Water
 - Sediment
 - “Tar” Seeps
- SVOCs – SW-846
 - Surface and Subsurface Soil
 - Groundwater
 - Surface Water
 - Sediment
 - “Tar” Seeps
- Metals – SW-846
 - Surface and Subsurface Soil
 - Groundwater

- Surface Water
 - Sediment
 - “Tar” Seeps
- Inorganics – SW-846 cyanide, ammonia
 - Surface and Subsurface Soil
 - Groundwater
 - Surface Water
 - Sediment
 - “Tar” Seeps

OTHER PARAMETER GROUPS

- Biogeochemical Parameters – dissolved gases including methane, carbon dioxide, carbon monoxide, nitrogen, and oxygen. Constituents in groundwater including chemical oxygen demand, sulfate, sulfide, alkalinity, nitrate, nitrite, ferrous iron, dissolved manganese, and dissolved organic carbon.
 - Groundwater
- Geotechnical Parameters – unit weight, moisture content, soil classification, atterberg limits, particle size, permeability, and strength.
 - Hillside Surface and/or Subsurface Soil Samples
- Surface Water List (SWL) – total suspended solids, total dissolved solids, biological oxygen demand, chemical oxygen demand, total organic carbon, alkalinity and hardness.
 - Surface Water
- Sediment List (SL) – total organic carbon, grain size, percent moisture and percent solids.
 - Sediment
- Aquifer Physical Properties (AQFPP) – porosity, grain size, moisture content, total organic carbon and bulk density.
 - Split-Spoon sample
 - Shelby Tube sample

- Aquitard Physical Properties (AQTPP) – vertical permeability
 - Shelby Tube sample
- Hazardous Characteristics – ignitability, reactivity and corrosiveness
 - “Tar” Seep sample

Constituent Practical Quantitation Limits (PQLs) and Method Detection Limits (MDLs) were compared to screening levels [USEPA Region III Risk-based Concentrations for soil and tap water and Federal Maximum Contaminant Levels (MCLs) for drinking water] and are presented in Appendix G. Soil/sediment PQLs are expressed on a dry weight basis.

Laboratory analytical results will be reported as follows:

- If the result is nondetect, it will be reported as a nondetect and flagged with a U qualifier [organics will be reported as PQL U, inorganic as the Instrument Detection Limit (IDL) U].
- Pace will report estimated values (flagged with a J qualifier) to the MDL for organics, to the IDL for metals, or to the threshold limit set for the instrument for organics and inorganics. That limit will be set at or below the MDL.
- If the result is greater than the PQL, the result will be reported without qualifiers.

1.8.2.15 Investigation-Derived Wastes

All liquid wastes (i.e., well development water, purge water, decon water and/or product) generated during the RFI will be temporarily containerized and transported to Hatcher's Pad area and discharged to the waste water treatment system for on-site treatment. All solid waste (i.e., soil cuttings) generated during the RFI will be temporarily containerized and transported to Sector A and placed in rolloff containers where WPSC maintains its less than 90-day hazardous waste accumulation area. The wastes will be tested to determine if it is characteristically hazardous prior to off-site transport and disposal. WPSC will manage the storage, characterization and off-site

disposal of all solid waste generated during the RFI. Any RCRA hazardous waste will be shipped off-site within 90-days of generation.

1.8.3 Task 3 – Human Health Risk Assessment

1.8.3.1 Conceptual Site Model

WPSC comprises approximately 588 acres and consists of asphalt parking lots, roads, buildings, railroad tracks, and fences to support coke production and processing activities that are described in detail in the DOCC. In general the entire area surrounding the facility is a highly industrialized area. Other industries supported in the area include coke and steel production and scrap metal recycling.

For the purpose of initial site screening only, a hypothetical unrestricted land-use condition, similar to an on-site residential scenario will be used. This scenario will not be used to establish ultimate clean-up goals. Because of the health-conservative nature of this scenario, risk managers will readily approve the “no further action” cases with a high level of confidence (USEPA, 1991a). In other words, sites found to have acceptable risks for the unrestricted land use will also have acceptable risks for other uses, such as commercial or industrial. Although a hypothetical on-site residential scenario is utilized for initial screening purposes only, the more probable future land use conditions at WPSC will be “like use,” mostly industrial/commercial. This is due to the high commercial value of available shoreline for shipping activities and the current industrial facilities surrounding the Site. The USEPA has stated, “sites that are surrounded by operating industrial facilities can be assumed to remain as industrial areas unless there is an indication that this assumption is not appropriate” (USEPA, 1992a). The WPSC facility is zoned for industrial used and has been an industrial facility for almost a century. Therefore, on-site commercial/industrial workers and construction workers are also included as potentially exposed populations in the CSM, to provide realistic exposure scenarios at WPSC. Receptors with a lesser degree of exposure, such a visitors, trespassers, or offsite workers and residents, are not considered in the CSM, unless the potential health risks to onsite populations are markedly unacceptable.

Pathways to be included in the CSM may involve exposure through the following media: indoor and outdoor air, surface and subsurface soil, surface water, sediment, and groundwater. The exposure routes via which human receptors are exposed to site-related COPCs in various environmental media at WPSC are ingestion, inhalation, and dermal contact.

1.8.3.2 Identification of Chemicals of Potential Concern

Typically, a comprehensive sampling program at a hazardous waste site identifies a list of chemicals detected in different environmental media (including ambient-related metals and laboratory contaminants) which can be burdensome to carry through the quantitative human health risk assessment (HHRA). Both the USEPA and Region III have recommended that the list of detected analytes (and potential exposure pathways) at a site be narrowed prior to the detailed analysis, through careful evaluation of the sampling programs and analytical data (USEPA, 1989a, 1993). The primary goal of this evaluation is to eliminate from further consideration those non-site-related chemicals (or pathways) that clearly pose a *de minimis* risk and retain site-related COPCs in the HHRA. This COPC identification process will help remedial engineers, risk managers, and the public focus the remedial effort on site-related chemicals that contribute the most to the overall health risks (termed “risk-driving” COPCs) and/or chemicals that are at least amenable to the selected remedy (termed “limiting” COPCs) (USEPA, 1991a). This more focused list of COPCs will facilitate the toxicity assessment step of the HHRA, in which both toxicity values and toxicological profiles for COPCs under study are presented (e.g., toxicological profiles should not be prepared for common laboratory contaminants or ambient metals).

The criteria to be considered in the identification of COPCs will include, but not be limited to:

- toxicity/risk potential;
- data qualifiers;
- field/laboratory contamination; and
- ambient levels.

1.8.3.2.1 Toxicity/Risk Potential

In order to identify chemicals that pose significant health risk, the maximum detected concentration of detected chemicals will be compared to their USEPA Region III Risk-based Concentration (with the exception of lead¹) (USEPA, 2000). RBCs are health-

¹ To identify lead as a COPC, the USEPA soil lead screening level of 400 mg/kg (USEPA, 1994a) and the drinking water action level of 15 µg/L (USEPA, 2002) will be compared to maximum detected concentrations of lead in soil and groundwater, respectively.

protective chemical concentrations that are back-calculated using toxicity criteria, a 1×10^{-6} target risk level or a 0.1 hazard quotient, and conservative exposure parameters. A hazard quotient of 0.1, instead of 1.0, will be used to add a ten-fold measure of safety, thereby ensuring that compounds that could combine to result in a hazard index greater than 1.0 are not eliminated from the assessment (USEPA, 1993). If the maximum detected on-site chemical concentration is less than the RBC, the probability of contracting cancer would be less than one-in-one-million, and adverse noncarcinogenic effects would not be expected to occur. As a result, only chemicals detected at levels greater than adjusted RBCs will be retained for evaluation. In addition to comparison with RBCs, detected concentrations of chemicals in groundwater will be compared with the primary MCLs for drinking water (USEPA, 2002). Chemicals detected at levels in groundwater greater than the primary MCLs will also be retained.

1.8.3.2.1.1 Comparison of Essential Human Nutrients to Allowable Daily Intakes

The maximum concentrations of the four essential human nutrients that do not have RBCs (i.e., calcium, magnesium, potassium, sodium) will be compared to dietary Allowable Daily Intakes (ADIs). Essential human nutrients detected at levels below ADIs are considered unlikely to cause adverse effects and will be eliminated from evaluation.

1.8.3.2.2 Data Qualifiers

Data to be used in the HHRA will include acceptable validated data without qualifiers and acceptable data with the following qualifiers:

- J – The reported concentration of the constituent is an estimated value;
- U – The constituent was analyzed for but not detected at or about the sample quantitation limit (SQL); and
- UJ – The chemical was analyzed for but not detected at or above the SQL, and the SQL is an estimated quantity.

All data qualified with an R (rejected) or N (tentatively identified) will not be considered in the HHRA (USEPA, 1989a and 1992a). The impact of excluded R- or N-qualified data in the HHRA will be qualitatively evaluated and discussed in the uncertainty section.

1.8.3.2.3 Field/Laboratory Contamination

In order to exclude non-site-related contaminant from the HHRA, all analytical results from the RFI will be reviewed to identify results that may be biased high due to potential laboratory or field contamination. The USEPA classified the following compounds as common laboratory contaminants: acetone, 2-butanone and methylene chloride (USEPA, 1989a, and 1992a). Sample results for these common laboratory contaminants will be considered detected and included in the relevant data set used to identify COPCs only if the reported concentrations in environmental samples exceeds ten times the maximum amount detected in the associated laboratory and field blanks. For organic and inorganic constituents not identified as common laboratory contaminants, sample results will be considered detected and included in the data set only if the reported concentrations in the samples exceeds five times the maximum detected amount in the associated field and laboratory blanks (USEPA, 1989a and 1992a).

1.8.3.2.4 Ambient Levels

All chemicals not eliminated by the above screening process will be identified as COPCs and evaluated in the HHRA. However, some inorganic chemicals occurring at concentrations above the USEPA Region III RBCs may not be reflective of site-related contamination, but instead, may indicate naturally elevated regional concentrations. Accordingly, the identification of chemicals occurring at concentrations below background concentrations may be useful when interpreting the results of the HHRA. Inorganic chemicals with maximum concentrations that exceeded USEPA Region III RBCs but are equal to or less than background concentrations will be selected as COPCs and designated with a "B" in subsequent data tables. The following procedures will be used to identify chemicals occurring at concentrations above background concentrations.

When at least five samples are available for both the on-site and background sample data sets, the data will be statistically compared (USEPA, 1996b). First, the chemical results will be log-transformed in order to meet the assumption of normality. An F-test will then be performed to determine if the variances of the on-site and background data are similar. If the variances for a given chemical in a given medium are found to be similar, then the two-tailed t-test will be used to test for differences between on-site and background means. If on-site and background variances are found to differ significantly, a nonparametric test (the Wilcoxin rank sum test) will be used to test for similarity between on-site and background means. A detailed description of the statistical tests is presented in Zar (1996).

When less than five samples are available for both the on-site and background sample data sets, the maximum concentration of each inorganic detected at the on-site location will be compared to the maximum concentration of that inorganic chemical detected in the background data grouping. If the maximum concentration of an inorganic chemical exceeds the maximum background concentration or if it is not detected in the relevant background data grouping, then that chemical will be considered to occur at concentrations above those in the background samples.

In addition, published data in literature may be considered for use in determining background concentrations of constituents.

1.8.3.3 Exposure Assessment

Exposure is defined as the contact of a receptor with a chemical or physical agent (USEPA, 1989a and 1992b). The goal of the exposure assessment is to identify and quantify known and hypothetical exposure pathways relevant to an assessment of public health risk at a site, and to determine the quantities or concentrations of the risk agents received by the potentially exposed populations (NRC, 1983; USEPA, 1992b). The exposure assessment is generally performed by determining the concentrations of chemicals in a medium at a location of interest (exposure point concentrations) and linking this information with the time that individuals or populations contact the chemicals (time of contact). Exposure assessment at a site also involves estimating human exposure from multiple routes, such as ingestion, dermal contact, and inhalation (USEPA, 1989a and 1992b), through a combination of direct measurements and mathematical models.

A complete exposure assessment consists of the following components:

- characterization of the exposure setting;
- identification of complete and potentially complete exposure pathways;
- fate and transport modeling;
- quantification of exposure, including exposure point concentrations and intake/uptake doses; and
- uncertainties related to exposure assessment.

1.8.3.3.1 Characterization of the Exposure Setting

The objective of this element is to discuss the physical setting of the site which may affect the decision on the types of exposure scenarios to be quantified in the HHRA. Some site description of WPSC is presented in the CSM. The information to be researched and presented here includes the demographic information regarding potentially exposed populations under both current and reasonably anticipated future land-use conditions. Relative population locations with respect to the site and subpopulations of potential concern will also be described. The following human receptors will be evaluated in the HHRA:

- Adult and child residents (for screening purposes only);
- Adult industrial/commercial workers; and
- Adult short-term construction workers (specifically excavation workers).

It should be noted that the construction worker scenario involves participation of different specialized crews performing specific tasks such as excavation/grading, framing, or electrical wiring. Except for workers performing excavation and grading, other crews have little contact with soil at the site. Thus for purposes of the HHRA, only potential health risks to excavation workers will be addressed.

1.8.3.3.2 Identification of Complete and Potentially Complete Exposure Pathways

According to USEPA (1989a), only complete or potentially complete exposure pathways under both current and future land-use conditions will be quantitatively evaluated in an HHRA. A complete exposure pathway consists of the following elements:

- a contaminant source and release mechanism;
- a retention or transport medium;
- an exposure point; and
- an exposure route at the exposure point.

If any one of these elements do not exist, the exposure pathway is considered incomplete and further evaluation of the health risks associated with the incomplete pathway is not required. A pathway is considered potentially incomplete if data to assess the significance of the pathway are unavailable or inconclusive.

1.8.3.3.2.1 Potential Soil Pathways

Complete and potentially complete soil exposure pathways that will be considered in the HHAR include, but are not limited to:

- incidental ingestion, dermal contact, and inhalation of indoor air by industrial/commercial workers; and
- incidental ingestion, dermal contact, and inhalation of ambient air by construction workers.

Additional pathways related to domestic uses by residents will be evaluated for screening purposes only and include the following:

- incidental ingestion, dermal contact, and inhalation of indoor and outdoor air by residents.

1.8.3.3.2.2 Potential Groundwater Pathways

Based on the information currently available, potential groundwater exposure pathways that will be considered in the HHRA include, but are not limited to:

- inhalation of indoor/ambient VOCs volatilized from groundwater by industrial/commercial workers and construction workers; and
- dermal contact with and inhalation of VOCs in groundwater by construction workers.

Additional pathways related to domestic uses by residents will be evaluated for screening purposes only and include the following:

- ingestion, dermal contact, and inhalation of groundwater as drinking water by residents.

1.8.3.3.2.3 Potential Surface Water/Sediment Pathways

There is potential for exposure to surface water/sediment in Mahan's run via recreational use (i.e. children playing). Domestic uses by residents will be evaluated and will include the following:

- ingestion, dermal contact, and inhalation of surface water/sediment by residents.

1.8.3.3.3 Fate and Transport Modeling

Exposure modeling techniques for WPSC will follow a tiered approach, ranging from screening level to complex computer models. Essentially, the COPC concentrations at relevant receptor locations will be initially estimated using screening level analysis for simple exposure estimates. If more accurate exposure estimates for air are required for a detailed risk characterization, advanced models will be selected by reviewing the USEPA Exposure Models Library – CD ROM (USEPA, 1996c) and consulting with in-house modeling experts, USEPA Region III or the Center for Exposure Assessment Modeling group in Athens, GA.

1.8.3.3.3.1 Soil and groundwater to indoor and outdoor air

In this element of the HHRA, simple or screening level environmental fate and transport models will be used to estimate exposure point concentrations in ambient and indoor air. Initial models considered for use at WPSC consist of simple algebraic equations which are described in USEPA *Soil Screening Guidance* (USEPA, 1996c) and Johnson and Ettinger (1991).

1.8.3.3.3.2 Groundwater to surface water

For the purposes of the HHRA, the use of surface water bodies in the vicinity of WPSC (i.e., Mahan's Run) will be investigated only if there is evidence of contaminant migration from the Hillside Area into Mahan's Run.

1.8.3.3.3.3 Soil to groundwater

In this element of the HHRA, contaminant transfer from soil to groundwater will also be evaluated in accordance with USEPA's Soil Screening Guidance document (USEPA, 1996c).

1.8.3.3.4 Quantification of Exposure

For each exposure pathway selected for quantitative evaluation, concentrations at the exposure points will be determined using data collected during the investigation. In accordance with USEPA (1989a and 1992c) guidance, the reasonable maximum exposure (RME) exposure point concentrations will be the 95% upper confidence limit (UCL) on the arithmetic mean, or the maximum detected concentration in a given medium/data grouping, whichever is less. Mean chemical concentrations for a given medium will be calculated by averaging the detected concentrations with one-half the detection limit of the non-detects. One-half the detection limit is typically used in risk assessments (USEPA, 1989a) when averaging non-detect concentrations because the actual value can be between zero and a value just below the detection limit. Data from duplicate groundwater samples (i.e., samples collected from the same sample location at the same time) will be averaged together and treated as one result. If a chemical is detected in only one of two duplicate samples, the detected value will be averaged with one-half the quantitation limit of the non-detect sample, and the result will be counted as one detect sample. Data from duplicate soil samples will be treated as individual samples due to the nature of the soil sampling process.

Next, for all chemicals except lead, exposures will be quantified for each receptor population by calculating lifetime average daily doses (LADDs) for exposure to chemical carcinogens and average daily doses (ADDs) for exposure to noncarcinogenic chemicals, following USEPA (1989a, 1992b) guidance. LADDs and ADDs will be based on the exposure point concentrations and assumptions regarding the frequency and duration of exposures, and the rate of intake (e.g., amount of soil ingested). In accordance with USEPA (1989a, 1992b) guidance, exposures will be quantified assuming a RME scenario. Dermal absorption of chemicals will be quantitatively evaluated following USEPA (1992b) guidance for dermal exposure assessment. Potential exposures to lead will not be evaluated using the LADD/ADD methodologies, this section will not provide quantitative estimates of lead exposures. Potential exposure to lead will be evaluated using USEPA models (1994b, 1996a) as discussed in the following Section.

1.8.3.4 Toxicity Assessment

The COPC will be characterized with respect to their toxic effects in humans, and relevant critical toxicity criteria will be identified for each chemical. Two types of dose-response toxicity criteria are used for the human health assessment: USEPA-derived cancer slope factors (CSFs) for potentially carcinogenic chemicals; and reference doses (RfDs) for chemicals exhibiting non-carcinogenic effects. For carcinogens, the chemicals' weight-of-evidence classifications for human carcinogenicity will be provided and discussed. For chemicals exhibiting non-carcinogenic effects, uncertainty factors used in deriving the RfDs will be provided, along with toxicity information such as target organs and effects endpoints. The primary source of the toxicity criteria will be USEPA's IRIS and HEAST. If necessary, USEPA Region III and the Environmental Criteria and Assessment Office (ECAO) may also be contacted for toxicological information, as well as for guidance on the evaluation of chemicals that do not have USEPA-published toxicity values. Toxicity profiles will be provided for all chemicals selected as COPC.

Because no dose-response toxicity criteria exist for lead, an alternative methodology will be used for determining adverse effects associated with potential lead exposures in the media evaluated in the assessment. Instead of quantifying potential doses and associated risks for each pathway, the HHRA will evaluate potential exposures to lead using the IEUBK model (USEPA, 1994b) for residents and USEPA (1996a) for commercial/industrial workers. Because these models were designed to be protective of individuals consuming lead-containing media, they are not relevant for use to determine if adverse effects could occur due to dermal absorption of lead while wading. Although no evaluation of dermal exposures to lead in surface water will be conducted, these exposures will be qualitatively discussed in the HHRA.

1.8.3.5 Risk Characterization

Potential human health effects will be characterized by combining estimated exposures (LADDs and ADDs) with appropriate USEPA dose-response criteria. The results of the risk characterization will include estimates of the upper-bound individual cancer risk estimates for carcinogens and a hazard index for non-carcinogenic effects. The individual lifetime excess cancer risk for a chemical exhibiting carcinogenic effects will be calculated by multiplying the upper-bound cancer slope factor by the estimated LADD averaged over 70 years. In addition, if risks in the WPSC HHRA exceed the 1×10^{-2} risk level, the one-hit cancer risk equation will be used. For non-carcinogenic effects, potential adverse effects will be calculated by means of a hazard index technique, in which the ADD is divided by the RfD, as recommended by USEPA

(1989a). A hazard index greater than a threshold level of 1.0 will trigger a detailed evaluation, in which hazard indices for groups of chemicals affecting similar target organs will be calculated. If a target organ-specific hazard index exceeds 1.0, there may be concern for potential health effects (USEPA, 1989a). Where cumulative risks are above the trigger levels for corrective action, a Monte Carlo simulation may be run to evaluate more realistic health risks for evaluating corrective action decisions.

As noted in the previous section, quantitative exposure estimates and risks will not be calculated for lead. Rather, in order to understand the magnitude of lead contamination at WPSC, models will be used to estimate blood lead levels and the results will be compared to USEPA criteria. The purpose of the models will be two fold. First, site-specific information will be input into the model to determine the potential blood-lead level of receptors. Second, the model will then calculate a risk of the receptor exceeding the 10 µg/dl blood level recommended by Centers for Disease Control (CDC). The IEUBK was developed specifically to evaluate exposures for children in a residential setting. A second model (USEPA, 1996a) will be used to evaluate industrial exposure. USEPA (1994a) limits exposure to soil lead levels such that a typical child would have an estimated risk of no more than 5 percent probability of exceeding the 10 µg lead/dl blood lead level.

1.8.4 Task 4 – Ecological Risk Assessment

A phased approach will be implemented to determine potential ecological risks associated with the Site. The goal of the phased approach is to use resources efficiently by performing tasks as is necessary to provide sufficient data for making decisions. Following the completion of each task, the decision is made whether to proceed and how best to proceed, based on the data collected up to that point. Each task is described below.

1.8.4.1 Ecological Inventory

An ecological reconnaissance and inventory will be conducted to provide information on potential receptors and habitats, potential exposure pathways, and general ecological conditions at the site. This information will be used to help determine whether potential contaminants are likely to pose hazards to ecological receptors.

The objectives of the ecological reconnaissance and inventory are to gather qualitative and semi-quantitative information on the ecological communities present or potentially occurring at the Site, describe the pathways by which biological receptors could potentially be exposed to media containing site-related constituents, and document

readily-apparent evidence of stress on biological receptors at the site. Data obtained from the ecological inventory will be used in preparing the ecological risk assessment if it is determined that such an assessment is warranted.

The ecological reconnaissance and inventory will include subtasks and procedures as described in the following sections.

1.8.4.1.1 Background Information Review

This task will consist of collecting and reviewing background information associated with the site. Information on the environmental setting and potential ecological receptors will be obtained by reviewing available background documents and contacting environmental data sources by telephone and/or in writing. These data will include biotic and abiotic data concerning the site and the surrounding area. Preliminary identification of any environmentally sensitive areas on or adjacent to the site will be included in this task. Telephone discussions will be documented with telephone conversation logs. Copies of letters regarding background information will be included in the report. Specific information collected during this subtask will include a list of plants and plant communities on-site and immediately surrounding the site, animals potentially occurring on-site and in the vicinity of the site, and the average annual flow of water bodies, if any, associated with the site. Specific data for the site and immediately surrounding area to be obtained or reviewed, where available, will include previous studies and/or reports, environmental contacts and databases, maps (topographic and soils), aerial photographs, and land use studies. Previous wetland work conducted at the site will be reviewed as part of this task.

Sensitive environments on or adjacent to the site will be preliminarily identified during this task. The West Virginia Division of Natural Resources (WVDNR) will be contacted in writing to obtain information on the potential occurrence of threatened or endangered species, critical habitat or other unique ecological resources at or near the facility. Any environmentally sensitive areas on or adjacent to the site will be identified including:

- Marine sanctuaries
- National and state parks
- Designated and proposed federal and state wilderness and natural areas
- Areas identified under the Coastal Zone Management Act
- Sensitive areas of the National Estuary or Near Coastal Waters Program

- Critical areas under the Clean Lakes program
- National monuments
- National and state historical sites
- National and state seashore, lakeshore and river recreational areas
- National and state preserves and forests
- National and state wildlife refuges
- Coastal barriers and units of a coastal barrier resource system
- Federal land designated for protection of natural ecosystems
- Spawning areas critical to the maintenance of fish/shellfish
- Migratory pathways and feeding areas critical to anadromous fish
- Terrestrial areas utilized for breeding by large or dense aggregations of animals
- River state or federally designated scenic or wild
- State lands designated for wildlife or game management
- Areas important to maintenance of unique biotic communities
- State-designated areas for protection or maintenance of aquatic life
- Wetlands, marshes, tidal flats, mangrove swamps.

1.8.4.1.2 Site Reconnaissance Visit

A site visit will be conducted to evaluate the characteristics of the site. A pedestrian survey of the site and surrounding areas will be conducted to identify terrestrial and aquatic habitats and to verify information acquired during Task 1.1. During the site reconnaissance visit, migration pathways for constituents to potentially reach ecological receptors will be identified and potential target populations will be noted. In addition, any signs of potential stress to vegetation or wildlife indicative of actual contamination at or around the site will be noted. If it is determined that ecological receptors could be exposed to constituents at the site, Task 2 (Constituent Screening) will be conducted.

1.8.4.2 Constituent Screening

Results of previous and on-going sampling and analysis of media at the site will be compared with available criteria, standards, and/or toxicological comparison values to preliminarily determine potential ecological risks. Criteria, standards, and comparison

values potentially used may include: state and federal ambient water quality criteria (AWQC); Ontario Ministry of Environment and Energy sediment screening values (OMEE, 1993); National Oceanic and Atmospheric Administration (NOAA) sediment screening guidelines for organics and inorganics (NOAA, 1994); state- and region-specific surface water and sediment screening values if available; Oak Ridge National Laboratory (ORNL) comparison values (Sample et al., 1996; Suter and Tsao, 1996; Will and Suter, 1995a,b); bibliographic and numeric databases (BIOSIS, PHYTOTOX), and/or literature derived toxicity values. Those constituents that do not exceed available comparison values will be eliminated from further consideration. Those that exceed available comparison values will be included as potential constituents of potential ecological concern (COPECs). Based on the results of this task, additional evaluation may be implemented.

1.8.4.3 Site-Specific Ecological Risk Assessment

If deemed necessary based on the results of Task 1 (Ecological Inventory) and Task 2 (Constituent Screening), a site-specific ecological risk assessment may be implemented. The objectives of the site-specific ecological risk assessment are: (1) to evaluate existing data and data collected at the site to determine potential site-related ecological effects; (2) to determine whether additional ecological field data collection and evaluation is warranted based on the results of the first objective. The steps followed in the site-specific ecological risk assessment will generally follow those outlined in the Framework for Ecological Risk Assessment (USEPA, 1992), and Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (USEPA, 1996) although additional USEPA guideline documents may be utilized (USEPA, 1989a,b). The standard paradigm presented in this framework include (1) problem formation; (2) exposure assessment; (3) effects assessment; and (4) risk characterization.

1.8.4.4 Problem Formulation

Problem formulation defines the source(s) of contaminants, describes the relevant attributes of the receiving environment (site description), selects the endpoints for the assessment and describes the conceptual model for the ecological risk assessment. The ecology of the site (from Task 1) will be described during this step. Potential environmental receptor populations will be identified based on the information collected during previous investigations, the ecological reconnaissance and inventory (Task 1), and from any available historical ecological surveys of the site or surrounding areas. Evaluation of potential environmental receptors will include an investigation of

historical data for the potential for threatened or endangered species to be present at or in the vicinity of the site. Based on the information developed in the problem formulation step, the following will be specified:

- The habitats and species (receptors) of ecological concern,
- Location and description of sensitive habitats and/or species,
- Constituents of potential ecological concern (COPECs) (from Task 2),
- Potential ecological effects associated with the site, and
- Studies used to characterize potential effects associated with the site.

1.8.4.5 Exposure Assessment

The exposure assessment evaluates the relationship between ecological receptors and potentially affected media at the site. Potential exposure pathways, exposed populations, and routes of exposure will be assessed. The exposure assessment will include information on feeding habits, life history, and habitat preferences of potential ecological receptors. An evaluation of fate and transport processes occurring at the site will also be included.

1.8.4.6 Effects Assessment

The effects assessment correlates concentrations of constituents in potentially affected media to adverse effects in receptors. Generally, literature reviews, field studies, and bioassay studies provide the information for these correlations. The ecotoxicity of COPECs will be evaluated based on review of available standards, criteria, and literature (from Task 2). Available COPEC toxicity information will be identified and discussed in the effects assessment.

1.8.4.7 Ecological Risk Characterization

The ecological risk characterization is an analysis of the likelihood and severity of potential or actual adverse effects on ecological receptors as a result of exposure to the COPECs. To characterize risks, all of the chemical and biological data related to the site will be evaluated, and the results of the exposure assessment and effects assessment will be integrated. The risk characterization will include a narrative discussion of the results, the associated uncertainties, and assumptions used in the

ecological risk assessment. Where the risk characterization establishes a correlation between COPECs and adverse effects, the ecological significance of these effects will be discussed.

As part of the ecological risk assessment, potential risks to wildlife that potentially use the site (e.g., deer) will be assessed by comparing estimated daily doses (from the exposure assessment) with toxicological benchmarks (from the effects assessment). This comparison called the hazard quotient (HQ) method, compares daily doses for a specific constituent to benchmark values to determine whether the receptor dose is less than or equal to an acceptable or "safe" dose. The HQ is defined as the ratio of the estimated daily dose of a constituent through a particular exposure route to the benchmark for the same constituent through that ingestion route. This process is similar to the calculation of the HQ for human health. The comparison will be made for each constituent and is expressed as:

$$HQ = \text{Dose (mg/kg-day)} / \text{benchmark (mg/kg-day)}$$

where:

HQ = hazard quotient;

Dose = estimated constituent dose for a given receptor; and

Benchmark = toxicological benchmark value.

Using this method, the degree to which a particular constituent concentration exceeds a toxicological benchmark can be evaluated. Therefore, an HQ greater than 1 indicates that a given exposure dose for a specific constituent exceeds the toxicological benchmark for a particular species. The greater the HQ, the greater the exceedence. An HQ less than 1 indicates that, for a particular constituent-species interaction, ecological risks are unlikely to occur.

1.8.5 Task 5 – Treatability Study/Pilot Testing

Potential remedial technologies proposed may require treatability studies and/or pilot testing to determine their effectiveness and applicability under existing site conditions. Treatability studies are often required for those technologies that are highly dependent

on the contaminant or medium characteristics. These tests determine the suitability of the technologies and are used to obtain operational data to evaluate the technology during the Corrective Measures Study.

Limited treatability studies will be performed as part of the RFI. One potential corrective measure associated with the “tar seeps” on the Hillside is capping. To assist in evaluating this potential corrective measure, soil and “tar” samples will be collected and analyzed for chemical and physical parameters during the RFI as described in Section 1.8.2.4. The results will be used to evaluate the chemical quality and stability of materials in the vicinity of the Hillside Area “tar seeps” in relation to potential corrective measures.

Based upon the current understanding of the study area conditions, no other treatability tests are proposed at this time. Should the results of the RFI or the CMS process indicate a need for treatability studies, a separate work plan will be developed for any proposed laboratory studies and submitted for USEPA approval apart from this Work Plan.

1.8.6 Task 6 – RFI Report

A RFI report will be prepared upon the completion of the Phase I RFI activities. This report will summarize the data collected and present conclusions and recommendations regarding additional data needs. The format and content of this report is discussed in more detail in the Data Management Plan.

1.9 Project Management

The management approach for the RFI centers on the use of frequent and proactive communication, timely monitoring of budget and schedule, maintaining flexibility to adapt to site conditions and requirements, and accountability. Management control of the project will be based on two fundamental methods of approach: partnering with WPSC and USEPA, and a streamlined cost-effective management structure. The first part of this approach will ensure that communication between CEC, WPSC and USEPA supports a complete understanding of the scope of work. This approach will also ensure that the strategic planning is accurately translated into the project activities.

The second aspect of this management philosophy is to provide a streamlined management structure based on using personnel in more than one functional role in the project. This means that management functions will be performed by team members

who also have technical responsibilities in specific aspects of the investigation. This type of approach enhances communication among task leaders and project manager, and helps to build a sense of ownership in the project, which leads to increased efficiency. CEC believes that this two-fold philosophy will provide an effective management approach to the project.

1.9.1 Site Management

This site management section describes the site access, security, and control to be exercised during the RFI. The field investigation team and associated subcontractors will strive to ensure that the public health, as well as public and private property, are protected to the fullest extent possible while conducting the RFI.

No field investigation team member will perform work at the site until: (1) written or verbal authorization is received from the Project Coordinator and Project Manager; (2) a written notice is provided to the USEPA Remedial Project Manager (RPM) at least 14 days before initiation of field activities; and (3) each field member has personal identification in the form of a driver's license, company identification card, or suitable substitute approved by the Project Manager. In gaining legal access to individual sampling or drilling locations at the site, no field investigation team member will sign or acknowledge any documents unless approved by the Project Manager. Access in such cases is the responsibility of and will be provided by WPSC. During the RFI access to the site will be restricted to either the north "Byproducts Area" or the south "contractors" entrance (Figure 5). All personnel will ingress/egress via the north entrance; all drilling equipment and any other heavy equipment or large trucks must ingress/egress via the south entrance.

All portable equipment will be returned to the field office or otherwise secured at the end of each work day. Any equipment left at a work site will be secured to prevent unauthorized removal or vandalism. Any unfinished monitoring wells shall be covered or capped in such a manner as to prevent tampering. Finished monitoring wells will be locked.

Prior to the initiation of any field activities, a "field-office" will be established at a location to be determined by WPSC. This "field-office" will serve as a central command post through the duration of the field investigation, providing communications, shelter, office space, and space for equipment storage and sample handling.

1.9.2 Project Management Structure

A proposed project organizational chart for the RFI is shown in Figure 9.

The management team for the WPSC RFI has been selected on the basis of the demonstrated abilities of the team members to manage large value, multi-task, multi-disciplinary projects. The responsibilities and management abilities of the proposed management personnel are described below.

The **Project Coordinator** is Mr. Bud Smith, Manager Environmental Control – Steel Division, Wheeling Pittsburgh Steel Corporation. Mr. Smith will be the lead contact for project correspondence and discussions between WPSC, USEPA, and CEC. The Project Coordinator will be assisted in the implementation of the RFI Work Plan by CEC.

Mr. David Olson, P.G., a Principal Hydrogeologist at CEC with over 16 years of experience in the environmental field, will serve as **Project Manager** and point of contact, responsible for managing all activities, providing review of documentation and communicating with WPSC.

Mr. James Nairn, P.G., a Principal at CEC with over 20 years of experience in the environmental field, will serve as the **Project Officer** and will be responsible for the overall quality of the entire project and its deliverables.

Mr. Robert Dlugos of CEC will serve as the **Field Operations Leader (FOL)** and is responsible for all day-to-day aspects of the RFI field work. The responsibilities of the FOL include:

- Assuring that all field team members are familiar with the RFI workplan and HASP; immediate responsibility for sampling operations, sampling quality control, and documentation and maintenance of the site logbook.
- Assuring that all field team members have completed health and safety training.
- Reporting to the Project Manager on a regular basis regarding the status of all field work and any problem encountered.
- Completing Field Change Request Forms, as necessary, for approval by the Project Manager.

Drilling Subcontractor:

Responsible for drilling permits and clearances and supplying all services (including labor), equipment, and material required to perform the drilling, testing, and well installation program, as well as maintenance and quality control of such required equipment. The drilling subcontractor will be responsible for following decontamination procedures specified in the RFI Workplan and HASP. Upon completion of the work, the drilling subcontractor will be responsible for demobilizing all equipment, cleaning any material deposited onsite during drilling operations, properly backfilling any abandoned borings, and restoring the work area to its original condition. The drilling subcontractor will at a minimum follow the specifications of the HASP.

1.9.3 Project Management Approach

The following paragraphs present a discussion of the proposed management approach that will be implemented to ensure completion of this project on time, on budget, and according to the quality assurance expectations. The Project Manager will be responsible for coordinating with and managing subcontractors, supervision of field operations and quality assurance (QA) program, data analysis, report preparation and meetings, and the maintenance of budgetary controls through the investigations. The Project Manager will review the scope with the Project Officer. Additionally, the Project Manager will ensure that the Task Managers participate in a project initiation meeting to establish a clear understanding of the work, including schedule, budget, means and methods to conduct the work, and deliverables. Staff assignments will be made to ensure that the work is conducted in accordance with the planned approach.

Based on the understanding of the scope of work, each Task Manager will delineate the work activities in sequence. Staff requirements will be identified and milestones will be specified, including interim and final deliverables and coordination meetings. A review team that is experienced in the project disciplines will then be assigned by the Project Manager to conduct periodic project performance reviews.

In reviewing each task, the QA/QC reviewers will consider a number of specific factors. The reviewers will focus on the technical soundness of theory and execution employed, compliance of the work with applicable codes and standards, including regulations, and satisfaction of the USEPA requirements. Project performance reviews will be conducted at critical milestones in the project development. In addition to review of technical performance, the QA/QC reviewers will also evaluate whether the work conforms to best practices, whether it is safe and will not fail, and whether it is

cost effective. Other factors considered in the project performance reviews will include protection of public health and the environment, short and long-term reliability, constructability, the ability of the work to obtain regulatory agency approval and permits, aesthetics, and risk management.

The primary responsibilities of the key personnel assigned to this project are summarized below:

<u>Position</u>	<u>Primary Responsibilities</u>
Project Coordinator Bud Smith	main point of contact with regulatory agencies ultimate project success
Project Officer James Nairn	ultimate project success overall project quality
Project Manager David Olson	overall project management project deliverables primary point of contact with WPSC QA/QC program project cost and schedule control management of key personnel problem identification and resolution
Field Operations Leader Robert Dlugos	task management task cost and schedule control management of task personnel production of scheduled deliverables

1.9.4 Communications

The Project Coordinator, Mr. Bud Smith will serve as the as the point of contact regarding day-to-day activities throughout the RFI project. It is the Project Coordinator's responsibility to effectively communicate to the USEPA the status of the project with respect to budget, schedule, work completed, problems encountered, external communications, and contractual matters. This will be accomplished through preparation and submittal of periodic progress reports. WPSC will prepare monthly progress reports for submission to USEPA outlining major accomplishments during the reporting period, and activities to be started or completed during the upcoming reporting period.

1.9.5 Project Schedule

WPSC and CEC are prepared to implement the proposed Phase I RFI Workplan activities upon notice to proceed from the USEPA. A minimum of a 20-day notification of the start of the field work will be provide to the USEPA. Figure 10 presents the proposed Schedule of Phase I RFI activities.

Within 30 days of notice to proceed, the Phase I activities will be initiated. The schedule reflects a 60-day period of time that allows WPSC and CEC to complete procurement and subcontractor contract procedures. The field activities are anticipated to require approximately 6 months to complete. Ten weeks have been allocated for laboratory analysis, data receipt, tabulation and validation before the data can be interpreted. Once all of the environmental data has been validated, the schedule reflects a seven (7) month period to prepare the baseline risk assessment and the RFI report.

1.10 Personnel Qualifications

CEC has formed a highly capable team to include expertise drawn from CEC, and associated specialty subcontractors and vendors. The project organization chart (Figure 9) clearly defines the key individuals.

1.10.1 Subcontractors and Other Services

CEC will pursue and execute a formal subcontract agreement with the subcontractors proposed for use on the project. Plans associated with specific work tasks will detail the proposed scope of work to be performed by the subcontractors and the associated costs. All subcontractors will be required to contribute estimates of labor hours, labor dollars, and equipment costs, as well as a scope of work schedule.

Specialty support services will be subcontracted with the following:

Drilling

Terra Testing, Inc. will provide hollow-stem auger and geoprobe drilling services.
Alliance Environmental, Inc. will provide sonic drilling services, if needed.

Analytical Laboratory

Chemical quality and physical quality analytical data will be generated by three different analytical laboratories.

The majority of the chemical quality data will be generated by **Pace Analytical** located in Export, Pennsylvania. Biogeochemical data will be generated by **Microseeps Inc.**, located in Pittsburgh, Pennsylvania.

Physical analysis of soil samples will be generated by **Geotechnics, Inc.**, located in Pittsburgh, Pennsylvania.

Ground Survey

A West Virginia licensed surveyor will be used to perform all surveying activities associated with the RFI. A contractor has not been selected at this time, however, USEPA will be afforded the opportunity approve the selection of surveyor prior to utilizing their services.

Waste Disposal

WPSC routinely utilizes the services of several qualified hazardous and non-hazardous waste disposal contractors. The selection of which contractor to be used for this project will be determined after investigation derived wastes have been generated and characterized. USEPA will be provided the opportunity to approve the selection of the waste disposal contractor prior to implementation of their services.

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